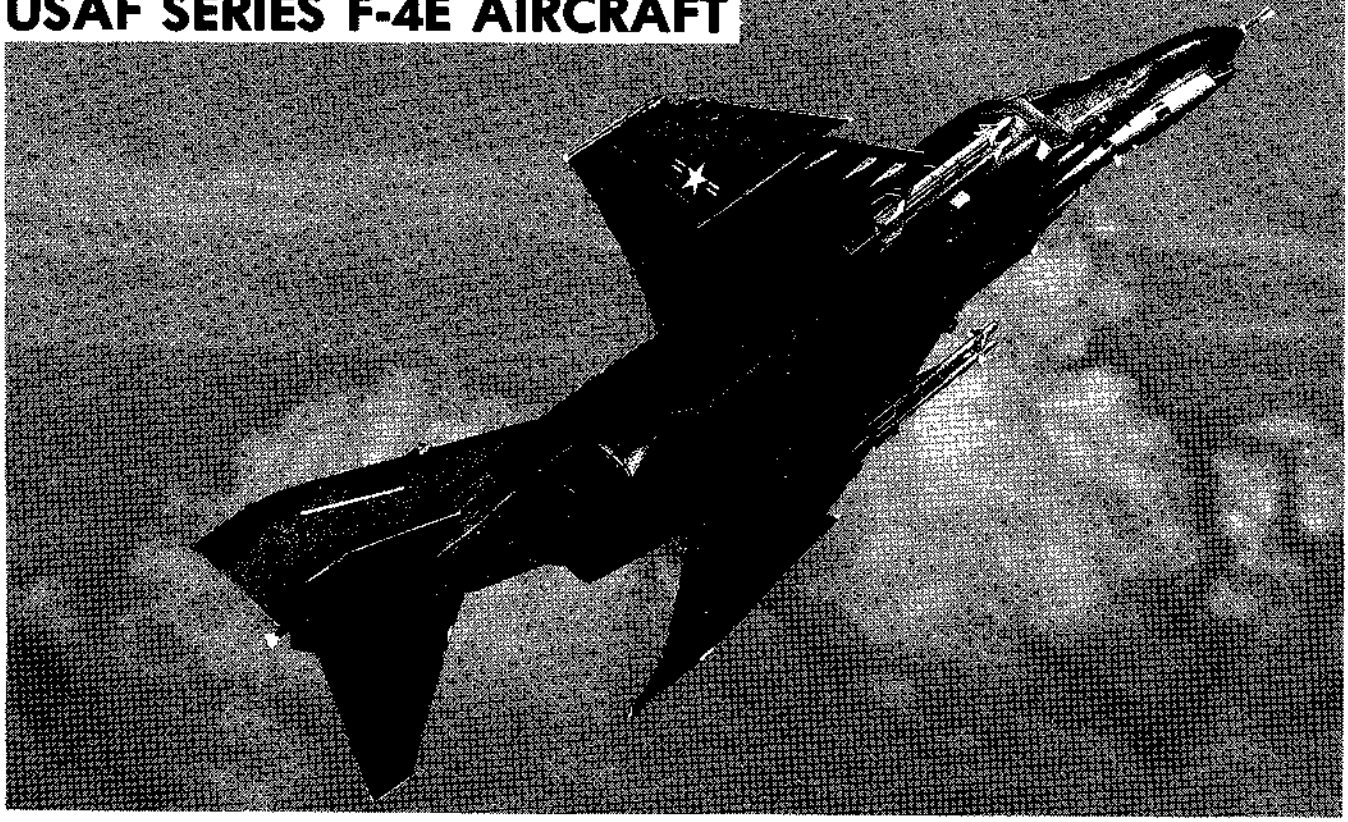
FLIGHT MANUAL

USAF SERIES F-4E AIRCRAFT



McDonnell Aircraft

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This manual supersedes TO 1F-4E-1S-102, SS-103, S-104, S-105 and S-106.

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Published under authority of the Secretary of the Air Force.

4E-1-(12)

AIR FORCE 9 AUG 90 — 4000

15 OCTOBER 1984

CHANGE 10 - 1 APRIL 1990

CURRENT FLIGHT CREW CHECKLIST

TO 1F-4E-1CL-1 1 November 1989 Change 1 - 1 April 1990

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

Dates of issue for original and changed pages:

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SAFETY/OPERATIONAL SUPPLEMENT SUMMARY

The following list contains: the previously cancelled or incorporated Safety/Operational Supplements; the outstanding Safety/Operational Supplements; if any; and the Safety/Operational Supplements incorporated in this issue. In addition, space is provided to list those Safety/Operational Supplements received since the latest issue.

NUMBER	SUBJECT OR DISPOSITION
All Safety/Operational Supplements thru TO 1F−4E−1S−101	Previously cancelled or incorporated.
TO 1F−4E−1S−102	Mode 4 audio after TO 1F−4−1495 incorporated in this issue.
TO 1F−4E−1SS−103	PC and utility pressure during single engine landing incorporated in this issue.
TO 1F−4E−1S−104 TO 1F−4E−1S−105 (Interim) TO 1F−4E−1S−106 (Interim)	Checklist correction incorporated in this issue.

SOFTWARE NOTICE

OPERATIONAL FLIGHT PROGRAM (OFP) SOFTWARE IDENTIFICATION/ CHANGE SUMMARY

The OFP number and the functional changes resulting from an OFP change are identified in the following table. This manual is changed or an Operational Supplement is issued to provide rapid distribution of the new function and remove the old function. OFP changes that do not affect the aircrew are not listed.

OFP NUMBER	EQUIPMENT AFFECTED	IDENTIFICATION/CHANGE
OFP 15.01	AN/ARN−101	OFP number is located in the power on interactive list, item 1.
*OFP V48113	AN/ASQ−203	OFP number is located in the initialization display.

* Or OFP version authorized by the F−4 System Program Manager.

TECHNICAL ORDER SUMMARY

The Technical Order Summary lists only those technical orders which affect this manual.

Technical Order	ECP	Title	Production Effectivity	Retrofit Effectivity
1F−4E−1167	827S2P1	Improvement of fuel feed system & incorporation of self sealing fuselage cells	68–495 and up	
	827S2 Part III	Adds provisions for mounting selective armor	68–452 and up	
1F-4-1226		Installs data transfer module	none	71–237 thru 74–1653
1F-4-1233	MOD 3064	Adds HAVE QUICK capability	none	All
1F-4-1241		Adds full time voice receiver capability to aux receiver	none	All
1F−4−1262		Adds voice warning system	none	All
1F−4−1308		Adds provisions for 600 gallon high performance centerline tank and modifies jettison circuitry	none	All
1F−4−1320	MOD 3025	Adds KY−58 Vinson secure voice UHF radio communication	none	66−284 & UP except F4E HARDWING configuration
1F−4−1414		Installed digital fuel quantity indicator	none	All
1F−4−1448		Installs HAVE QUICK II System	none	All
1F−4−1484		Adds aural warning (fire−fire) to voice warning system	none	All
1F−4−1503		Modification of the F−4 aircraft fire/overheat detection system	none	All
1F-4E-591	7226R1	Adds AN/ALR-46 radar warning system	72-1498 and up	66-284 thru 72-1497
1F-4E-610	7087R2	Adds AGM-65/A (maverick) missile capability	71-237 and up	66-284 thru 69-7589 (selected aircraft)
1F-4E-611 1F-4E-617	7242R2	Installs Digital Scan Converter Group	74-00643 and up	66-284 thru 69-7589 (selected aircraft)
1F-4E-626	MOD 2917	Installs digital modular avionics system (DMAS)	none	71-237 thru 74-1653
	MOD 2974	Installs Pave Tack Pod	none	71-237 thru 74-1653

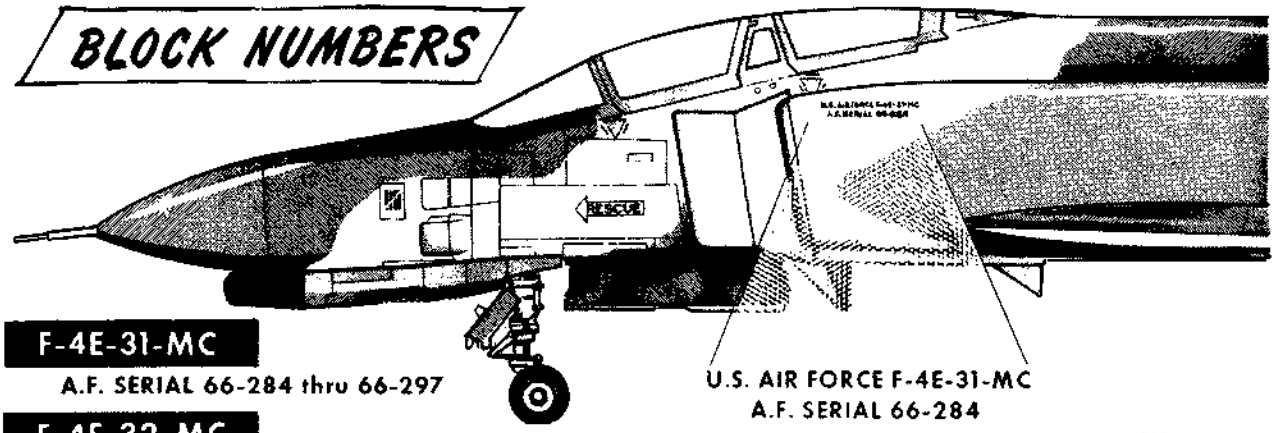
CONTINUED

TECHNICAL ORDER SUMMARY

The Technical Order Summary lists only those technical orders which affect this manual.

Technical Order	ECP	Title	Production Effectivity	Retrofit Effectivity
1F-4E-637	MOD 2974	Adds sensor select panel and Pave Tack pod controls	none	71-237 thru 74-1653
1F-4E-639 or 1F-4-1138	2916	Adds airborne video tape recorder system	none	67-283 thru 69-7589 and 71-237 thru 74-1653 (selected aircraft)
1F-4E-643		Installs control lens indicator	none	71-237 thru 74-1653
1F-4E-663		DMAS OFP update	none	71-237 thru 74-1653
	7177	Adds target identification system electro-optical (TISEO)	71-237 and up	none
	MOD 3107	Modifies aircraft for low smoke engine and high energy ignition	none	Selected aircraft
	MOD 2999	Adds GBU-15 and data link control panel	none	71-237 thru 74-1653
1F-4-1252		Install AN/APN-232(V) (CARA) in non DMAS/ NWDS F-4 aircraft	none	Selected aircraft.
1F-4-1495		Removal of KY-532B and replacement with KY-532C, F-4 aircraft	none	All
1F-4E-671		Installs Navigation and Weapon Delivery System AN/ASQ-203 (NWDS)	none	Selected aircraft

BLOCK NUMBERS



U.S. AIR FORCE F-4E-31-MC
A.F. SERIAL 66-284

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F-4E-44-MC
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A.F. SERIAL 69-7546 thru 69-7578

F-4E-45-MC
A.F. SERIAL 69-7579 thru 69-7589

F-4E-48-MC
A.F. SERIAL 71-224 thru 71-247

F-4E-49-MC
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4E-1-(113)B

STABILATOR AUXILIARY POWER UNIT (APU)

On aircraft 68–452 and up, an APU system provides backup hydraulic pressure for longitudinal control. An electrically driven hydraulic pump pressurizes the APU system to 1700 ±100 psi. The APU supplies pressure to the PC–1 side of the stabilator actuator and pitch stab augmentation if PC–1 pressure drops below 1000 psi. Fluid pressure is sufficient to supply stabilator demands of moderate flight maneuvers including landing. Flight speed is restricted below 600 knots/.95 Mach with normal load factors from 0 to +4 G. Stick rate input is limited to 1 G per second. A pressure switch in the pump illuminates an APU light on the telelight panel, when the pump is operating. Stick movement in pitch can cause the APU light to flicker or remain ON for as long as six seconds. This is normal and should be disregarded. It does not indicate actual operation of the APU. An APU reject switch provides an option to reject the APU system should PC–1 pressure drop below 1000 psi (left engine shut down) with the PC–2 system operating normally. This switch also has a test position for ground check of the system. Operation of the system is automatic, provided the reject switch is in NORMAL, as soon as PC–1 drops below 1000 psi. If the reject switch is in REJECT, operation is automatic as soon as PC–2 pressure drops below 1000 psi (provided PC–1 has previously failed or the left engine was shut down). Momentary drops of the PC system below 1000 psi will cause the APU system to be energized. A holding relay in the control system will keep it activated for 1 minute after the PC pressure has recovered.

Auxiliary Power Unit Reject Switch

The APU reject switch, on the outboard engine control panel, is a three position switch marked NORMAL, REJECT and TEST. The TEST position is spring loaded to REJECT and provides an operational check of the APU system with external power (engines shut down). The NORMAL position provides automatic operation of the APU system if PC–1 pressure drops below 1000 psi. The REJECT position is lever locked and provides an option to de–activate the APU after PC–1 fails, and PC–2 is still operating normally. Placing the switch to REJECT (after PC–1 failure) turns off the APU and completes a circuit to automatically re–activate the APU system if PC–2 should also fail. Loss of PC–2 with a good PC–1 system will not activate the APU.

APU Light

The APU light, on the telelight panel, illuminates anytime the APU is operating. A holding relay in the control circuit causes the light and APU to remain on for 1 minute, if momentary PC pressure drops occur. The APU light does not illuminate the MASTER CAUTION light.

If the APU CONT circuit breaker (F–5, No. 1 Panel) has been pulled after the system has been activated in flight, the light will remain on until the APU pump pressure bleeds off.

UTILITY SYSTEM

The utility hydraulic system is pressurized to 3000 ±250 psi by a hydraulic pump on each engine. To prevent the utility hydraulic pumps from resonating, check valves with different operating pressures are installed on the pump output lines. As a result, the right engine utility hydraulic pump will deliver 2775 ±225 psi at idle rpm, and the left engine utility hydraulic pump will deliver approximately 3000 ±250 psi at idle rpm. The utility hydraulic system supplies hydraulic pressure to the:

AFCS
Aileron Power Control Cylinders
Aileron Dampers
Aileron–Rudder Interconnect
Air Refueling Receptacle
Anti–Skid
Arresting Hook (retraction)
Auxiliary Air Doors
Slats Flaps
Forward Missile Cavity Doors
Fuel Transfer Pumps (hydraulic)
Gun Drive
Gun Gas Purge Door
Landing Gear
Lateral Control Servo (autopilot)
Nose Gear Steering
Pneumatic System Air Compressor
Radar Antenna Drive
Roll Stab Aug
Rudder Damper
Rudder–Feel System
Rudder Power Control Cylinder
Speed Brakes
Spoiler Power Control Cylinders
Variable Engine Bellmouth
Variable Engine Intake Duct Ramps
Wheel Brakes (normal and emergency accumulator)
Yaw Stab Aug

HYDRAULIC PRESSURE INDICATORS

Two hydraulic pressure indicators are on the pedestal panel in the front cockpit. One is for the utility system and one is for the PC–1 and PC–2 systems. The power control systems indicator has two pointers, one labeled 1 for PC–1 and the other 2 for PC–2.

HYDRAULIC SYSTEMS INDICATOR LIGHTS

An amber CHK HYD GAGES indicator light is on the telelight panel. This single light is utilized by both the power control systems and the utility system to indicate loss of hydraulic system pressure and direct the pilot's attention to the hydraulic pressure indicators. Illumination of the CHK HYD GAGES indicator light is controlled by the hydraulic systems pressure switches. The CHK HYD GAGES light illuminates when the pressure in any one system drops below 1500 ±100 psi and/or when one of the utility hydraulic pumps fail. In all cases a loss of system pressure will be noted on the applicable hydraulic pressure indicator, but, a failed utility pump may not register a significant pressure drop on the utility pressure indicator. An illuminated CHK HYD GAGES light with no noted pressure drop on any of the hydraulic pressure indicators usually signifies that the right utility hydraulic pump has failed. An illuminated CHK HYD GAGES light in conjunction with a utility hydraulic pressure drop of 200 psi signifies that the left utility pump has failed. The MASTER CAUTION light illuminates in conjunction with the CHK HYD GAGES indicator light. The MASTER CAUTION light may be

extinguished by depressing the reset button. The CHK HYD GAGES light remains illuminated until the pressure in the faulty system increases beyond 1750 psi. If a failure occurs in one of the remaining hydraulic systems while the CHK HYD GAGES light is already illuminated, the MASTER CAUTION light will not illuminate again and the pilot will not be alerted to the second failure.

NOTE

The MASTER CAUTION and CHK HYD GAGES lights may illuminate momentarily due to high system demand when the landing gear is lowered or with rapid control movement. If pressure recovers without delay, disregard this indication.

PNEUMATIC SYSTEM

The pneumatic system provides high pressure air for the normal and emergency operation of the canopies, and the emergency operation of the landing gear and slats flaps. Refer to foldout illustrations for Pneumatic System illustration.

In flight, the pneumatic system pressure may indicate below the minimum 2650 psi due to a compressor malfunction or the moisture separator freezing up. Normally, water collected in the moisture separator is discharged automatically at the same time the compressor reaches its cutoff limit of 3050 to 3200 psi. When system pressure gets below 2650 psi, the dump valve closes and allows the compressor to cut−in again. If the heat blanket fails, ice can form and clog the dump valve in the open position. This allows system pressure to bleed off slowly. Cycling the pneumatic system control circuit breaker may provide a power surge sufficient enough to close the dump valve solenoid allowing pneumatic system pressure to return to normal. However, the problem may repeat itself when the dump valve opens at compressor cutoff. If cycling the circuit breaker does not work, a descent to a lower altitude will be necessary to thaw ice in the moisture separator and allow the system to reset itself. If the circuit breaker is out and will not reset, the compressor will not run and pneumatic system pressure will continue to bleed off.

NOTE

Consideration should be given to lowering gear while utility hydraulics are available. If pneumatic pressure is below the green zone and utility hydraulics are lost, there may not be sufficient pressure in the emergency air bottles (due to the possibility of leaking check valves) to lower the gear.

PNEUMATIC PRESSURE INDICATOR

A pneumatic pressure indicator, located on the pedestal panel in the front cockpit shows only manifold pressure.

FLIGHT CONTROLS

The aircraft primary flight controls are the stabilator, rudder, ailerons, and spoilers. Refer to foldout illustrations for Flight Controls schematic. Artificial feel systems provide simulated aerodynamic forces to the control stick and rudder pedals. Secondary controls are slats flaps and speed brakes.

AILERON–SPOILER CONTROL SYSTEM

The control system uses PC–1 and utility hydraulic systems for the left aileron–spoiler, and PC–2 and utility hydraulic systems for the right aileron–spoiler. If one hydraulic system fails, the remaining system for that aileron–spoiler provides adequate control.

Lateral Control Feel and Trim System

When the trim switch is actuated, screwjack actuators extend and retract. The lateral controls are repositioned and the control stick follows the trim movements. Lateral control artificial feel is provided.

STABILATOR CONTROL SYSTEM

Longitudinal control is provided by a single–unit horizontal tail surface (stabilator). Hydraulic pressure to the stabilator is supplied by both PC–1 and PC–2 systems. If one PC system fails, the remaining system provides adequate control. An AFCS servo is integrated into the stabilator system. It positions the stabilator in the same manner as control stick inputs. As a result, when the autopilot signals for a pitch attitude change, the control stick will follow the movement. On aircraft 68–452 and up, an APU supplies hydraulic pressure to the PC–1 side of the stabilator actuator if the PC–1 system fails.

Stabilator Control Feel and Trim System

Artificial feel is provided by a ram air bellows. When the aircraft is in trim, ram air force on the bellows is balanced by a bob weight. As airspeed increases or decreases, the pressure on the bellows changes, causing the bellows bob weight assembly to become off balance. The off balance condition is transmitted to the control sticks. Actuating the trim switch causes the stabilator trim actuator to move, balancing the force between the bellows and bob weight, eliminating force on the control sticks.

EMERGENCY ATTITUDE INDICATOR OPERATION

To initially erect the emergency attitude gyro, pull the cage knob out and hold until the indicator displays 0° in pitch and roll. Release the knob and within 3 minutes the gyro will be fully erected. Adjust the miniature airplane level with horizon bar. After the aircraft is in flight and in a wings level attitude, rotate the cage knob to adjust the miniature airplane on the indicator to the desired pitch position. The mechanical erecting mechanism will drive the indicator to the desired position at the rate of 3° per minute. Do not recage the gyro.

NOTE

Recage the gyro only when large errors are present. Large errors can be induced by more than 10° banks for such a period of time that an error of more than 10° is present which locks out the erecting mechanism. If recaging is necessary, attain a wings level attitude, recage the gyro and maintain the level attitude for 2 minutes after caging.

FLIGHT DIRECTOR GROUP

The flight director group provides an integrated display of the navigation situation of the airplane (figure 1-15). The flight director group consists of a flight director computer, the horizontal situation indicator (HSI), and a navigation function selector panel. The pilot selects various navigation information on the HSI and steering information on the ADI by positioning the bearing/distance selector knob and mode selector knob on the navigation function selector panel. On selected aircraft, navigation/steering information displayed by the flight director group is integrated with the DMAS or NWDS. Although the DMAS or NWDS is not a component of the flight director group, it supplies signals to the flight director computer and flight director instruments. DMAS or NWDS operation is discussed in this section only as it applies to flight director group operation. With the DMAS or NWDS, the flight director computer receives drift angle, relative bearing, and roll signals from the DMAS or NWDS to compute steering information displayed on the ADI. The DMAS or NWDS supplies range, relative bearing, course deviation, and course information to the HSI.

NWDS FLIGHT DIRECTOR STEERING COMMANDS

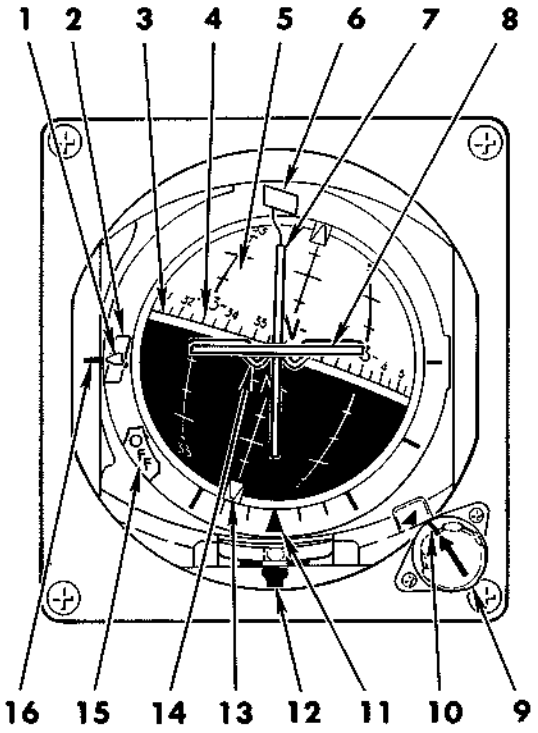
Roll Steering Error

The roll Steering Error is the difference between the commanded roll of the aircraft and the current roll of the aircraft. The Roll Steering Error is used to drive the Bank Steering Bar on the ADI and the Roll Tabs on the LCOSS and consequently limited to 30°. Roll Steering Error calculations provide steering cues to the pilot to achieve the required bank angle in order to obtain the desired course (i.e., Great Circle Course in Direct Track Steering Mode and Selected Course in the Course Select Steering Mode). For example; if the NWDS commands a bank angle of 60° and the pilot has only achieved a 45° bank, the NWDS continues to indicate an additional bank angle of 15° is required (ADI Bank Steering Bar indicating one half of a full scale deflection). Once the aircraft has achieved the required bank angle, NWDS commands indicate to the pilot to maintain the current bank by keeping the Bank Steering Bar centered. Once NWDS determines that the pilot must reduce the current bank angle to begin roll out on course, NWDS will indicate this by providing bank steering cues in the opposite direction indicating to the pilot to roll out. When the INU is not providing attitude information to the ACU the Roll Steering Error is equal to the Roll Steering Command.

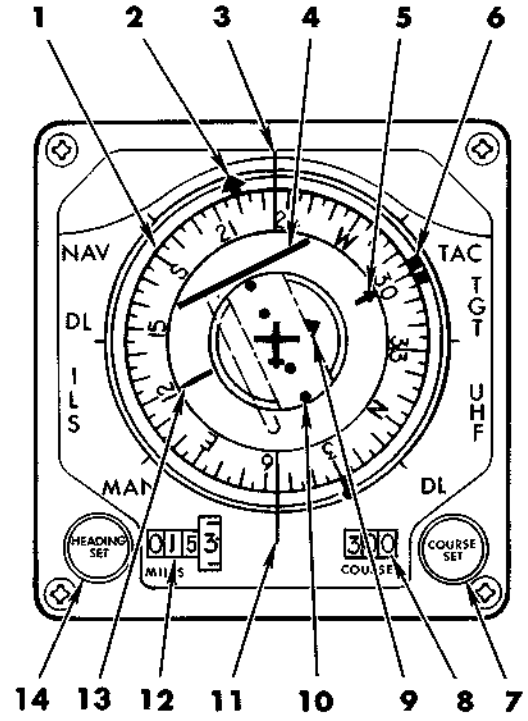
Pitch Steering Error

The Pitch Steering Error is the difference between the commanded pitch of the aircraft and the current pitch of the aircraft. The Pitch Steering Error is used to drive the Pitch Steering Bar on the ADI and consequently limited to 30°. The Pitch steering Error calculations provide steering cues to the pilot necessary to achieve the desired flight path angle (Approach-To-Landing and Pull Up Maneuver) or AGL altitude (Altitude Hold). For example, if the operator is performing an Approach-To-Landing and has deviated from the desired flight path (above desired flight path) NWDS provides pitch down steering. Once the pilot initiates the descent and begins reducing the flight path angle deviation, NWDS begins to reduce the pitch down command based upon the current deviation and rate of descent. If the pilot continues to descend towards the desired flight path and NWDS determines that the aircraft will descend below the desired flight path based upon the current rate of descent, NWDS begins indicating a pitch command on the Pitch Steering Bar, indicating to the pilot that the rate of descent must be reduced. Upon the operator capturing the desired flight path the Pitch Steering Bar becomes centered on the ADI, indicating to the pilot that the current aircraft situation is correct to maintain the desired flight path. When the INU is not providing attitude information to the ACU the Pitch Steering Error is equal to the Pitch Steering Command.

ADI/HSI (ATTITUDE DIRECTOR INDICATOR/ HORIZONTAL SITUATION INDICATOR)



1. GLIDE SLOPE INDICATOR
2. GLIDE SLOPE WARNING FLAG
3. HORIZON BAR
4. HEADING REFERENCE SCALE
5. ATTITUDE SPHERE
6. COURSE WARNING FLAG
7. BANK STEERING BAR
8. PITCH STEERING BAR
9. PITCH TRIM KNOB
10. PITCH TRIM INDEX
11. BANK SCALE
12. TURN AND SLIP INDICATOR
13. BANK POINTER
14. MINIATURE AIRCRAFT
15. ATTITUDE WARNING FLAG
16. GLIDE SLOPE DEVIATION SCALE



1. COMPASS CARD
2. BEARING POINTER
3. UPPER LUBBER LINE
4. COURSE DEVIATION INDICATOR
5. COURSE ARROW (HEAD)
6. HEADING MARKER
7. COURSE SET KNOB
8. COURSE SELECTOR WINDOW
9. TO-FROM INDICATOR
10. COURSE DEVIATION SCALE
11. LOWER LUBBER LINE
12. RANGE INDICATOR AND WARNING FLAG
13. COURSE ARROW (TAIL)
14. HEADING SET KNOB

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Figure 1-15

WARNING

Pitch steering indications are erratic and erroneous information may be displayed. Do not use the pitch steering bars during the approach.

NAVIGATION FUNCTION SELECTOR PANEL

The navigation function selector panel (figure 1–16) is on the front cockpit instrument panel. The panel contains a bearing/distance knob and a mode selector knob.

The bearing/distance selector knob controls the bearing pointer and range indicator displays on the HSI (figure 1–17). Knob positions are VOR/TAC, TAC, ADF/TAC, and NAV COMP. With VOR/TAC selected, magnetic and relative bearing to the VOR station and range to the tacan station are displayed on the HSI's bearing pointer and range indicator. With TAC selected, magnetic and relative bearing and range to the selected tacan station are displayed. With ADF/TAC selected, magnetic and relative bearing to the selected ADF station and range to the tacan station are displayed. With NAV COMP selected, magnetic and relative bearing and range are provided to the destination in the navigation computer.

The mode selector knob controls all the other navigation displays on the HSI (i.e. CDI, TO/FROM indicator, heading set marker, etc.) as well as pitch and bank steering bars on the ADI (figures 1–18 thru 1–20). The mode selector knob operates independently and does not affect information displayed by the bearing pointer or range indicator. Any of the navigation modes selected by the pilot illuminates a mode of operation word message light on the HSI when the instrument panel lights control knob is ON. Intensity of the mode lights is also controlled by this knob. The mode words are: TAC (tacan), NAV (navigation computer), UHF (ADF), MAN (HDG), ILS (instrument landing system), and TGT (target). During radar offset bombing operations illumination of the TGT mode word indicates that the WSO has pressed the TGT insert button on the cursor control panel. The data link (DL) light does not come on since this mode is not available. The mode selector knob positions are: VOR/ILS, TAC, NAV COMP and HDG.

The flight director (FD) switch on the mode selector knob controls whether the pitch and bank steering bars on the ADI will function as directed by the mode selector knob or be driven out of view. For example, with the FD switch in the OFF (vertical) position, the bank steering bar normally used to direct a course interception in the TAC mode is out of view.

On DMAS/NWDS aircraft, the mode selector knob on the navigation function selector panel is modified to replace the NAV COMP mode with two new modes of operation, computer navigation (CMPTR NAV) and approach (CMPTR APR).

NAVIGATION FUNCTION SELECTOR PANEL

WITHOUT NWDS/DMAS

WITH NWDS/DMAS

4E-1-(497)53

Figure 1-16

HORIZONTAL SITUATION INDICATOR

The HSI (figure 1−15) provides a horizontal or plan view of the aircraft with respect to the navigation situation. The navigation situations available for display on the HSI, as chosen by the navigation mode selector knob position, are listed here.

NOTE

On aircraft with NWDS, if VOR/ILS, VOR/TAC, or TAC/TAC cannot be entered during flight, check NWDS for an AIU fault. Clear the AIU fault before reattempting the other Nav mode.

a. When the VOR/ILS mode is selected the heading marker is positioned by the heading set knob to the desired magnetic heading. The course arrow is positioned by the course set knob to the VOR radial or inbound front course localizer. The course deviation indicator displays the aircraft deviation from the selected VOR radial or inbound front course localizer.

b. The tacan mode provides a display of a navigation situation with respect to the selected tacan. To provide a complete tacan display, the bearing/distance switch should be in the TAC position. The course arrow and the course selector window are set manually, using the course set knob, to the desired tacan course. The course deviation indicator and aircraft symbol display a plan view of the aircraft in relation to selected course. The maximum deflection of course deviation indicator is 10° (5° per dot). The heading set knob is used to manually set the heading marker to a desired tacan course, thus providing bank steering information on the ADI to command an asymptotic approach to the desired tacan course, The bank steering bar does not correct for drift. If the heading marker is not set to the desired course, bank steering information is not correct for course interception. The to−from indicator operates when the mode selector is in the tacan mode or the VOR/ILS mode when a VOR or tacan station is tuned and received. It indicates whether the course selected, if intercepted and flown, takes the aircraft to or from the selected station.

c. Without DMAS or NWDS, the NAV COMP mode displays (figure 1−20) the aircraft magnetic ground track on the course arrow and course selector window. The heading marker is electrically driven to indicate appropriate magnetic heading (command heading) to fly in order to arrive at the selected nav comp fix. The bank steering bar provides bank steering information to direct an asymptotic approach to the command heading. With DMAS, in the CMPTR NAV (computer approach) modes, the HSI receives signals from the DMAS by way of the signal data computer. In the CMPTR NAV mode, three HSI displays, direct track (DIR TRK), HSI course (HSI), or keyboard course (KYBD), can be selected by the pilot. With the course select switch in the DIR TRK position, the HSI course deviation indicator displays cross track velocity. Maximum deflection of the course deviation indicator is 100 feet per second (50 feet per dot). Bearing to the destination computed in the DMAS is displayed on the HSI course arrow and HSI course selector window. The heading marker displays the required magnetic heading to fly to the DMAS destination, and the compass card displays aircraft magnetic heading. With the course select switch in the HSI position, the course deviation indicator displays position relative to the selected course. Full scale deflection of the course deviation indicator is 10,000 feet (5000 feet per dot). The course arrow and course selector window display the course selected by the course set knob. The heading marker displays the required heading to fly to the DMAS destination, and compass card indicates aircraft magnetic heading. With the course select switch in the KYBD position HSI displays are the same as those for the HSI position of the course select switch, except for the course arrow and course selector window, which display the keyboard course. The CMPTR APR mode enables the pilot to select a computer approach to a DMAS destination. CMPTR APR mode operation is displayed on the HSI and ADI. In CMPTR APR, the HSI course deviation indicator displays cross−track error in feet. Maximum deflection of the course deviation indicator is 2500 feet (1250 feet per dot). The course arrow and course selector window display the course set. The required heading to fly to the runway on the desired course is indicated by the heading marker and the compass card indicates aircraft magnetic heading. In CMPTR APR, the DMAS defaults to KYBD course whenever DIR TRK or KYBD is selected. If the keyboard course is invalid, the steering disengages.

d. With NWDS, in the CMPTR NAV (computer navigation) modes the HSI receives signals from the NWDS by way of the AIU for steering to the current NWDS destination. Bearing to the current NWDS destination is displayed by the HSI course arrow and in HSI course selector window. The heading marker displays the required magnetic heading to fly to the current NWDS destination, and the compass card displays the aircraft magnetic heading. The course deviation indicator displays position relative to the course to the current NWDS destination. Full scale deflection of the course deviation indicator is 10,000 feet (5000 feet per dot).

e. With NWDS, in the CMPTR APR (computer approach) mode the HSI and ADI display a computer approach to the current NWDS destination. The course deviation indicator displays crosstrack error in feet. Maximum deflection of the course deviation indicator is 2500 feet (1250 feet per dot). The course arrow and course selector window display the course set with the course set knob. The heading marker displays the desired course to fly to the runway and the compass card displays the aircraft magnetic heading.

f. When HDG is selected, the course arrow and course deviation indicator are slaved to the lubber line and display aircraft magnetic heading. The course selector window also displays magnetic heading. The heading marker may be manually set to the desired heading. This provides ADI bank steering bar information to command an asymptotic approach to the selected heading.

ATTITUDE DIRECTOR INDICATOR (ADI) (W/O NWDS)

Signals to the ADI (figure 1–15) are received from the primary or standby attitude reference system. Either system can be selected by placing the reference system selector switch, located on the pilot's main instrument panel, to the desired position. When the reference system is changed from PRIM to STBY or vice versa, the ADI may temporarily swing to some random point in azimuth before synchronizing back to the correct heading, and may be accompanied by some unusual gyrations of the attitude director indicator sphere. This phenomenon is a simultaneous large gyration about all three axes after which normal attitude reference is displayed. The pitch reference relationship of the attitude sphere to the miniature aircraft may be adjusted with the pitch trim knob. The turn indicator in the lower portion of the ADI receives its signal from a gyro housed within an AN/AJB–7 system component. However, the operation or malfunction of one system will not affect the other system. The bank steering bar provides command steering information to intercept selected headings, tracks, tacan or VOR radials, or navigation computer destinations. Bank steering commands from the heading marker and/or course arrow are transmitted through the flight director computer to the bank steering bar. The maximum bank angle commanded by the bank steering bar is 35°. If bank angles of more than 35° are desired heading/course

HORIZONTAL SITUATION INDICATOR BEARING AND DISTANCE DISPLAYS

THE BRG/DIST SWITCH CONTROLS ONLY THE INDICATIONS DISPLAYED BY THE BEARING POINTER AND RANGE INDICATOR OF THE HSI.

BEARING DISTANCE SWITCH

VOR/TAC (VOR/TACAN)

THE BEARING POINTER INDICATES MAGNETIC BEARING TO THE VOR STATION SELECTED. THE RANGE INDICATOR INDICATES THE NAUTICAL MILES TO THE TACAN STATION SELECTED (TACAN IN T/R MODE). THE VOR LIGHT ILLUMINATES IF A VOR FREQUENCY IS SELECTED.

BEARING DISTANCE SWITCH

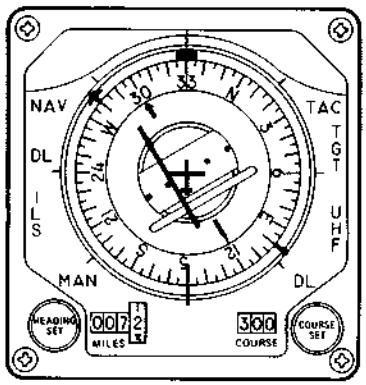
ADF/TAC (AUTOMATIC DIRECTION FINDER/TACAN)

THE BEARING POINTER INDICATES RELATIVE BEARING TO THE UHF STATION SELECTED ON THE COMMUNICATION CONTROL PANEL (EITHER COMM OR AUX ADF POSITION MUST BE SELECTED). THE RANGE INDICATOR WINDOW WILL DISPLAY SLANT RANGE TO THE TACAN STATION (TACAN IN THE T/R MODE). THE UHF LIGHT WILL BE ILLUMINATED.

BEARING DISTANCE SWITCH

NAV COMP (NAVIGATION COMPUTER)

THE BEARING POINTER INDICATES MAGNETIC BEARING TO THE DESTINATION SELECTED ON THE NAV COMPUTER. THE RANGE INDICATOR INDICATES THE NAUTICAL MILES TO THE DESTINATION SELECTED ON THE NAV COMPUTER (TARGET OR BASE). THE NAV LIGHT WILL BE ILLUMINATED.



BEARING DISTANCE SWITCH

TAC (TACAN)

THE BEARING POINTER INDICATES MAGNETIC BEARING TO THE SELECTED TACAN STATION. THE RANGE INDICATOR INDICATES THE SLANT RANGE NAUTICAL MILES TO THE TACAN STATION (FOR DISTANCE INDICATIONS, THE TACAN SELECTOR SWITCH MUST BE IN THE T/R POSITION). THE TAC LIGHT WILL BE ILLUMINATED.

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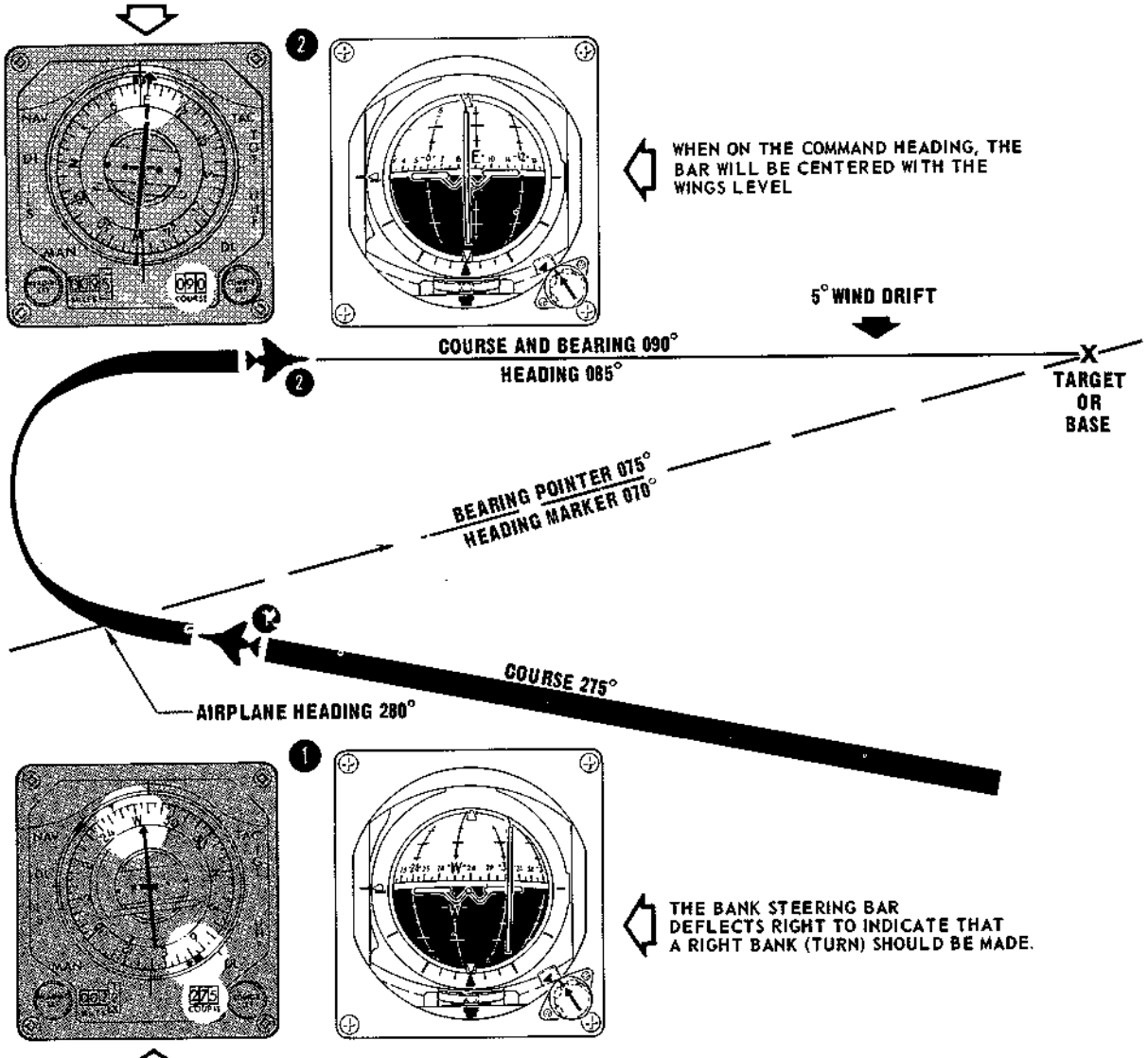
Figure 1-17

NAVIGATION COMPUTER DISPLAYS

WHEN ON THE COMMAND HEADING, THE HEADING MARKER WILL BE UNDER THE LUBBER LINE. THE COURSE ARROW AND COURSE SELECTOR WINDOW DISPLAY MAGNETIC GROUND TRACK WITHIN NAV COMPUTER ACCURACY. THE DIFFERENCE BETWEEN THE AIRCRAFT HEADING AND THE BEARING POINTER IS WIND DRIFT.



THE HEADING MARKER INDICATES THE MAGNETIC HEADING THAT MUST BE FLOWN TO MAKE GOOD A COURSE DIRECT FROM THE PRESENT POSITION OF THE AIRCRAFT TO THE DESTINATION (TARGET OR BASE) SELECTED ON THE NAV COMPUTER. WHETHER THE HEADING IS CORRECT OR NOT IS DEPENDENT UPON THE ACCURACY OF THE WIND DIRECTION AND VELOCITY, THE VARIATION, AND THE ACCURACY OF THE PRESENT POSITION. THE COURSE ARROW INDICATES THE MAGNETIC TRACK THAT IS CURRENTLY BEING MADE GOOD, ALSO DEPENDENT UPON THE ACCURACY OF THE NAV COMPUTER SETTINGS. THE COURSE DEVIATION INDICATOR IS SLAVED TO THE COURSE ARROW. THE COURSE SELECTOR WINDOW WILL INDICATE THE SAME MAGNETIC TRACK AS THE COURSE ARROW. THE BEARING POINTER INDICATES MAGNETIC BEARING TO DESTINATION. IN ORDER TO OBTAIN NAV COMPUTER INFORMATION FROM THE BEARING POINTER AND THE RANGE INDICATOR, THE BRG/DIST SWITCH MUST BE IN THE NAV COMP POSITION. IN THE REAR COCKPIT, WITH THE NAVIGATION MODE SELECTOR SWITCH IN THE NAV COMP POSITION THE BDHI NO. 1 POINTER WILL INDICATE MAGNETIC BEARING TO THE DESTINATION, AND THE NO. 2 POINTER WILL INDICATE MAGNETIC GROUND TRACK OF THE AIRCRAFT. THE BDHI RANGE INDICATOR WILL DISPLAY DISTANCE TO THE DESTINATION IN NAUTICAL MILES, AND THE AIRCRAFT MAGNETIC HEADING IS INDICATED UNDER THE LUBBER INDEX.

4E-1-(88)B

Figure 1-20

interception, the steering bar must be disregarded. During course interceptions, bank steering information is reliable when aircraft position is within a 60° arc either side of the selected tacan course, or within a 90° arc either side of the selected VOR course, and the heading set marker is set to the selected course. An OFF warning flag on the ADI is visible during the start cycle time delay; when the AN/AJB-7 gyro ac power fails; when the AN/AJB-7 pitch or roll signals fail; or while the fast erect switch is being activated. The attitude warning flag indicates only a failure in the AN/AJB-7 system regardless of the position of the reference system selector switch, and will not be in view if there is a failure or power loss within the INS.

WARNING

- Failure of certain components can result in erroneous or complete loss of pitch and bank presentations without a visible warning indication.
- If there is a confirmed or suspected ADI failure, switch to the standby attitude reference system and cross check ADI indications with the radar horizon line and emergency attitude indicator.
- The radar horizon line receives its input from the INS when the reference system selector switch is in the PRIM position and from the AN/AJB-7 when in the STBY position. If the INS fails, the ADI will indicate incorrect aircraft attitude, and the reference system selector switch should be placed to STBY immediately.

On aircraft 71-237 thru 74-1653 with PRIM selected, bank and pitch attitude signals are provided to the ADI sphere from the DMAS inertial measurement unit. The information displayed on the ADI by the bank and pitch steering bars and glide slope indicator is a function of the navigation function mode select and course select switches. With the mode selector knob in CMPTR NAV, the pilot may obtain a different lateral command steering display on the bank steering bar for each position of the course select switch. The commanded bank steering indication is to the course selected by the HSI course set knob when the course select switch is in HSI, or to the course selected by the DMAS keyer control when the course selector switch is in KYBD. With the course select switch in DIR TRK, the bank steering indication commands a course directly to the point set in the DMAS. When the mode selector knob is in the CMPTR NAV position, the pitch steering bar is out of view for all course select switch positions, except when the BLIND weapon delivery mode is selected. In BLIND, pitch steering for weapon release at the break attitude is displayed on the ADI. In the automatic navigation mode of DMAS operation, navigation systems provide the ability to fly to sequential destinations (D and T) with command steering information in roll supplied to the ADI and AFCS (altitude hold). Command roll steering displayed with the bank steering bar is to the destination or weapon release point (during weapon delivery) set in the DMAS. Transition rates and roll attitudes from one leg of route to another are computed by the DMAS and displayed as roll commands on the bank steering bar, based on the sequential steer destinations set in the DMAS. Under DMAS control, bank steering command corrections for cross-track error are limited to a rate of change of 10° per second. The value of cross-track error used by the DMAS in the computation of roll steering commands is limited to provide a constant 57° angle of approach to the selected course. This cross-track error limit is continuously computed by the DMAS based on current aircraft ground speed. DMAS roll commands are limited in 45° in roll unless computer approach is selected, course capture is achieved, or the aircraft altitude exceeds 20,000 feet when the roll commands are limited to 30°.

NOTE

Attempts to maintain an even altitude of 20,000 feet may result in small fluctuations in system altitude, thus causing the DMAS roll commands to alternate between 30° and 45°.

With the delivery mode selector switch in BLIND, the glide slope indicator displays time to weapon release. At approximately 12 seconds before release the glide slope indicator drops into view. Each dot thereafter represents 5 seconds. At 10 seconds the indicator is at the lower limit (second dot down from level). At 5 seconds the indicator is at the first dot down from level. At release the indicator indicates level flight. At time-to-release values of greater than 12 seconds, the glide slope indicator is out of view. In the CMPTR APR mode, bank steering information is to a course identical to the predetermined runway heading. If the course select switch is in KYBD or DIR TRK, keyboard steering is provided to the course entered in the desitnation list. If no course has been entered in the destination list, steering disengages. If HSI is selected, the pilot dials in the desired course using the HSI course knob. Direct track steering is not provided in the CMPTR APR mode. Refer to Course Selector Switch. When the aircraft is less than 20 nautical miles from the runway, the glide slope indicator displays the aircraft's position relative to the glide slope angle inserted with the DMAS keyer control. Maximum deflection of the glide slope indicator represents 165 feet. At a distance of 20 nautical miles or less from the runway, the pitch steering bar comes into view and displays glide path command steering information. The pitch steering bar remains in view until the aircraft reaches the go-around altitude above AGL inserted in the DMAS.

In the CMPTR NAV and CMPTR APR modes, a fault detected in the DMAS navigational computer or signal data converter causes the course warning and glide slope warning flags to come into view. If data received from the ADC is invalid, the glide slope warning flag is in view. In the CMPTR APR mode, a fault in the DMAS navigational computer or signal data converter causes the course and glide slope warning flags to come into view and the pitch steering bar to drive full up. The course warning flag also comes into view in the CMPTR APR mode unless LRN INT or LRN INS mode is selected and loran is not locked−on.

ATTITUDE DIRECTOR INDICATOR (ADI) (WITH NWDS)

Signals to the ADI (figure 1−15) are received from the NWDS source (primary) or AN/AJB−7 (standby) attitude reference system. When primary is selected, NWDS determines the validity of the input from the INU, and if invalid, supplies AN/AJB−7 attitude data if available. Either PRIM (Primary) or STBY (Standby) can be selected using the Reference System Selector switch on the ADI. When the reference system is changed from PRIM to STBY or vice versa, the ADI may temporarily swing to some random point in azimuth before synchronizing back to the correct heading, and may be accompanied by some unusual gyrations of the ADI sphere. This phenomenon is a simultaneous large gyration about all three axes after which normal attitude reference is displayed. The pitch reference relationship of the attitude sphere to the miniature aircraft may be adjusted with the pitch trim knob. The bank steering bar provides command steering information to intercept selected headings, tracks, TACAN or VOR radials, or navigation computer destinations. Bank steering commands from the heading marker and/or course arrow are transmitted through the flight director computer to the bank steering bar. The maximum bank angle commanded by the bank steering bar is 60°. If bank angles of more than 60° are desired during heading/course interceptions, the bank steering information must be disregarded. During course interceptions, bank steering information is reliable when aircraft position is within a 60° arc either side of the selected TACAN course, or within a 90° arc either side of the selected VOR course, and the heading set marker is set to the selected course. The pitch steering bar provides steering commands in the ILS mode after glide slope capture. An OFF flag on the ADI is visible when a failure in ac power or invalid NWDS data (PRIM) or AN/AJB−7 data (STBY) is detected.

WARNING

- Failure of certain components can result in erroneous or complete loss of pitch and bank presentations without a visible waring indication.
- If there is a confirmed or suspected ADI failure, compare attitude readings with the WSO, crosscheck the emergency attitude indication, and switch to STBY(AN/AJB−7 attitude input).

With PRIM selected, pitch and bank attitude signals are provided to the ADI sphere from the primary NWDS attitude source (INU or AN/AJB−7). The INU is the primary attitude source. If the INU fails, with the Reference System Selector switch in PRIM, NWDS will automatically provide AN/AJB−7 pitch and roll inputs to the flight instruments if available. Selection of STBY or SYNC on the compass controller is required in order to receive valid ADI heading information.

The information displayed on the ADI by the pitch and bank steering bars and glide slope indicator is a function of the switch positions on the Navigation Function Selector Panel (NFSP) Bearing and Distance (BRG/DIST) and Mode switches, and NWDS operating mode (i.e., navigation or weapon delivery mode). NWDS operating modes will have no effect upon ADI steering displays unless the NFSP BRG/DIST and Mode switches are positioned to Computer Navigation (CMPTR NAV) or Computer Approach (CMPTR APR). With the NFSP Mode switch in CMPTR NAV position, the pilot may obtain different lateral steering commands via the bank steering bar for each NWDS steering mode, as selected by the WSO or programmed by the NWDS.

In the CMPTR NAV and CMPTR APR modes, certain faults detected in NWDS causes the course warning and glide slope warning flags to come into view. In the CMPTR APR mode, NWDS faults can cause the course and glide slope warning flags to come into view and the pitch steering bar to drive full up.

BEARING – DISTANCE – HEADING INDICATOR (BDHI)

The BDHI (figure 1-21) displays are controlled by positioning of the bearing/distance selector switch in the rear cockpit. In the TACAN/ADF/UHF (upper) position, the no. 1 pointer indicates UHF magnetic and relative bearing and no. 2 pointer indicates tacan magnetic and relative bearing. If the tacan is not operating, both the no. 1 and no. 2 pointers indicate ADF bearing. In the VOR/TAC (middle) position, the no. 1 pointer indicates VOR magnetic and relative bearing and the no. 2 pointer indicates tacan magnetic and relative bearing. If the tacan is not operating, the no. 1 and no. 2 pointers both indicate bearing to the VOR station. The range indicator displays range to the selected tacan station. Without NWDS, in the NAV COMP (lower) position, the no. 1 pointer indicates magnetic and relative bearing to the selected navigation computer target coordinates and the no. 2 pointer indicates magnetic ground track. The range indicator displays range to the selected navigation computer target coordinates.

After TO 1F−4E−626, the BDHI range indicator and no. 1 and no. 2 pointers are driven by the DMAS when the BDHI mode selector switch is in the NAV COMP position. The range indicator displays the range to the selected DMAS destination. The no. 1 pointer displays magnetic and relative bearing to the DMAS destination, and the no. 2 pointer displays the DMAS computer magnetic ground track. All other BDHI displays remain unchanged.

With NWDS, the NAV COMP (lower) position, the no. 1 and no. 2 pointers are driven by the NWDS. The range indicator displays the range to the selected NWDS destination. The no. 1 pointer displays relative bearing to the NWDS destination, and the no. 2 pointer displays the NWDS ground track.

COURSE SELECT PANEL (AIRCRAFT 71-237 THRU 74-1653)

The course select panel is on the front cockpit instrument panel and contains a labs aid/wpn list selector knob, a course selector switch, a navigation pointer selector switch, an invalid labs lights, and a weapon in range light. For a description of the lights, refer to TO 1F-4E-34-1-1-2. The course select panel selects course data to be displayed on the ADI and HSI. Steering displays in the front cockpit are not affected by the course select panel unless the navigation mode selector knob is in CMPTR NAV or CMPTR APR mode.

Course Selector Switch

The course selector switch is a three-position, pull-to-release toggle switch with the positions of DIR TRK, HSI, and KYBD. The switch selects the course to be displayed on the HSI, and used by the DMAS. With the course select switch in DIR TRK, a direct track course to the DMAS destination is displayed. In the HSI position, the course set with the HSI course set knob is displayed and used for steering computations. In the KYBD position, the course set with the DMAS keyer control for the selected destination is displayed on the HSI. If CMPTR NAV mode is selected and no course has been entered for the selected destination, the DMAS will default to DIR TRK.

When in CMPTR APR mode and KYBD or DIR TRK is selected, the DMAS attempts to use KYBD course steering. If the KBYD course is invalid because no course has been entered for the selected destination, the DMAS will disengage steering, the steering bar will be out of view until a course is inserted. When in CMPTR APR mode and HSI course is selected, the HSI inserted course will be used.

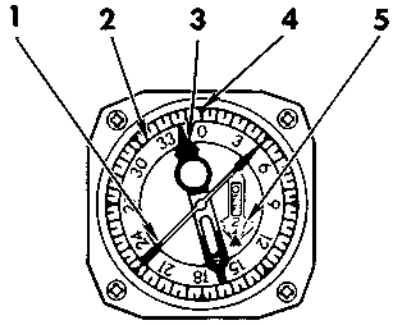
LABS Aid/Wpn List Selector Knob

This knob selects weapon delivery data. Refer to TO 1F-4E-34-1-1-2 for description of the knob functions.

Navigation Point Selector Switch

The navigation point selector switch is a three-position, pull-to-release toggle switch with positions of DEST A, DEST B, and KYBD. The KYBD position selects course data to the DMAS inserted destination and is the normal operating position of the navigation point selector switch. DEST A and DEST B switch positions are intended as emergency destinations if the keyer control fails. Regardless of the destination set in the DMAS, selecting of DEST A or DEST B provides a direct track, HSI, or DMAS keyboard selected course to the selected emergency destination, depending on the position of the course selector switch, if the destination has been inserted and validated in the destination interactive list.

BDHI (BEARING-DISTANCE-HEADING INDICATOR)



1. NO. 1 POINTER
2. COMPASS CARD
3. NO. 2 POINTER
4. LUBBER INDEX
5. RANGE INDICATOR

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Figure 1-21

position with respect to the selected VOR radial, the to–from indicator is activated, and if tacan is operating, the range indicator displays slant range to the tacan station. In the rear cockpit, if the navigation mode selector switch is in VOR/TAC and both VOR and tacan are operating, the BDHI displays VOR bearing on the No. 1 pointer, tacan bearing on the No. 2 pointer, and tacan slant range on the range indicator. If tacan is not operating, the VOR bearing is displayed on both BDHI pointers and a flag covers the range indicator.

NOTE

VOR information is unreliable if the HSI bearing pointer and the BDHI No. 1 pointer move to a stationary 4 o'clock position, and/or if the ADI course warning flag comes into view. Unreliable VOR information is displayed under marginal VOR signal conditions, such as maximum VOR radio range.

To initiate the ILS System, rotate the NAV volume control knob clockwise from OFF. Select the runway localizer frequency on the VOR/ILS control panel. Set the HSI course arrow and the course selector window to the ILS final approach course. Place the navigation mode selector knob to VOR/ILS and the ILS mode light on the HSI will illuminate. When the aircraft receives a valid localizer signal, the course warning flag on the ADI and the localizer warning flag on the course indicator are driven from view, the localizer identification tone is heard in the headsets and the ADI bank steering bar deflects to indicate in which direction to bank the aircraft and steer to intercept the localizer beam. The bank steering bar commands an asymptotic approach to the localizer centerline. Operational requirements may require a faster intercept in which case the bank steering bar should be disregarded and the intercept completed with reference to the CDI. The HSI course deviation indicator and the CI localizer pointer deflect to indicate the aircraft position with respect to the localizer beam. A strong crosswind may cause the aircraft to track slightly off-center and parallel to the course with the bank steering bar centered. Once established on course, the pilot must provide drift correction by reference to the CDI to stay on the course centerline. As the aircraft continues inbound on the localizer approaching the glideslope from below, the ADI glideslope indicator and CI glideslope pointer deflect to indicate the aircraft position with respect to the glideslope and the ADI pitch steering bar pops into view indicating in which direction to steer the aircraft to reach glideslope center. Marker beacons associated with the approach will cause the marker beacon lights to illuminate and an identification tone to be heard as the aircraft passes overhead.

IDENTIFICATION SYSTEM (IFF)

The identification system provides automatic identification when challenged by surface or airborne radar sets. Supplementary purposes are to provide momentary identification of position upon request, and to transmit a specially coded response to indicate an emergency. In operation, the identification system receives coded interrogation signals and transmits coded response signals to the source of the challenge. Proper reply indicates the target is friendly. Three modes of operation are provided for interrogation or response to interrogation signals. These are known as Mode 1, Mode 2, and Mode 3/A, which are used for security identification, personal identification and traffic identification, respectively. Controls are provided for on the IFF control panel for a fourth mode, Mode 4. The codes for Modes 1 and 3/A can be set in the cockpit, but the code for Mode 2 must be set on the ground. Mode 2 can be set from code 0000 to code 7777.

IFF CONTROLS AND INDICATORS

The controls on the IFF control panel are shown in figure 1–25. There is also an IFF and an ALT ENCODER OUT light on the telelight panel. Steady illumination of the IFF light indicates that the Mode 4 code is zeroed (no code inserted). The ALT ENCODER OUT light illuminates if the altitude reporting signal from the altitude encoder unit is unreliable.

Master Switch

The master switch is a five position rotary switch which controls the operation of the entire system as indicated below:

OFF	Identification system deenergized.
STBY	Full power supplied to the system, but with interrogations blocked.
LOW	System operates with reduced sensitivity.
NORM	System operates at full sensitivity.

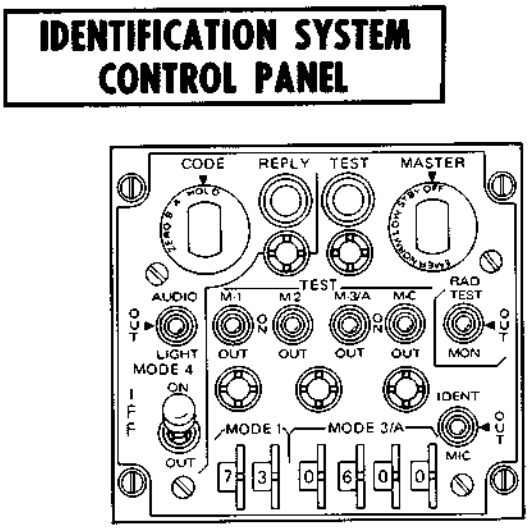

Figure 1–25

EMER	Allows the system to respond to interrogations in MODES 1, 2 and 3/A. The reply for Modes 1 and 2 is a special emergency signal of the codes selected on the applicable dials, while Mode 3/A replies are special emergency signals of code 7700.

Mode 1 Selector Switch

The three position Mode 1 selector switch controls the operation of Mode 1 as follows:

M–1	Self test position. (Inoperative)
ON	Enables Mode 1 for operation.
OUT	Disables Mode 1.

Mode 2 Selector Switch

The three position Mode 2 selector switch controls operation of Mode 2 as follows:

M–2	Self test position. TEST light illuminates if Mode 2 is operating properly.
ON	Enables Mode 2 for operation.
OUT	Disables Mode 2.

Mode 3/A Selector Switch

The three position Mode 3/A selector switch controls operation of Mode 3/A as follows:

M–3/A	Self test position. TEST light illuminates if Mode 3/A is operating properly.
ON	Enables Mode 3/A for operation.
OUT	Disables Mode 3/A.

Mode C Selector Switch

The three position Mode C selector switch controls operation of Mode C as follows:

M–C	Self test position. (Inoperative)
ON	Enables Mode C operation.
OUT	Disables Mode C

Mode 1 and Mode 3/A Code Selectors

The Mode 1 code selector is used to select Mode 1 codes for 00 to 73. The Mode 3/A code selector is used to select Mode 3/A codes from 0000 to 7777.

Mode 4 Selector Switch

The two position selector switch controls the operation of Mode 4 as follows:

ON	Enables Mode 4 for operation.
OUT	Inhibits Mode 4 reply. If Mode 4 code inserted, interrogation will cause the IFF warning light and the MASTER CAUTION light to come on momentarily.

Mode 4 Indication Switch

This switch has positions of AUDIO, OUT, and LIGHT. In AUDIO, an audio signal indicates Mode 4 interrogations are being received, and the Mode 4 REPLY light illuminates when replies are transmitted. In LIGHT, the Mode 4 REPLY light illuminates when Mode 4 replies are transmitted and audio is not present. In OUT, both light and audio indications are inoperative. The indication switch must be in the AUDIO or LIGHT position to test the press-to-test mode 4 reply indicator light.

NOTE

After TO 1F−4−1495, when the AUDIO−OUT−LIGHT switch is selected to AUDIO and a valid Mode 4 interrogation is received, a REPLY light will illuminate and no audio tone will be heard in the headset.

Mode 4 Function Switch

This switch has positions of ZERO, B, A, and HOLD. When the switch is placed to A, the systems transponder responds to Mode 4 interrogations from an interrogator using the same setting as set into the A position. In B, interrogations from an interrogator using the same code setting as that set into the B positions are answered. If the switch is in the wrong position for the code being interrogated (e.g., in A with B interrogation), the IFF warning light and MASTER CAUTION light will not come on. The code settings for the A and B positions are inserted before flight. Both code settings can be zeroed by placing the Mode 4 function switch to ZERO. The HOLD position is not used in flight but it is used to retain the code setting if another flight is anticipated during the code period. Positioning the switch momentarily to HOLD after landing before placing the IFF master switch and radar power knob to OFF will retain the code with the power off. Illumination of the IFF warning light and MASTER CAUTION light can be caused by an internal component failure, a failure to respond to a valid interrogation, or a zeroized code.

Monitor–Radiation Test Switch

This switch has positions of RAD TEST, MON, and OUT. The switch is placed to the OUT position and is not used during flight.

OXYGEN DURATION CHART

OXYGEN DURATION-HOURS

COCKPIT ALTITUDE FEET	GAGE QUANTITY-LITERS										
	10	9	8	7	6	5	4	3	2	1	BELOW 1
35,000 and UP	24.3 24.3	21.8 21.8	19.4 19.4	17.0 17.0	14.6 14.6	12.1 12.1	9.7 9.7	7.2 7.2	4.8 4.8	2.4 2.4	-EMERGENCY- DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
30,000	17.8 18.0	16.0 16.2	14.2 14.4	12.5 12.6	10.7 10.8	8.9 9.0	7.1 7.2	5.3 5.4	3.5 3.6	1.7 1.8	
25,000	13.7 17.0	12.3 15.3	10.9 13.6	9.6 11.9	8.2 10.2	6.8 8.5	5.4 6.8	4.1 5.1	2.7 3.4	1.3 1.7	
20,000	10.3 19.2	9.3 17.2	8.3 15.3	7.2 13.4	6.2 11.4	5.1 9.6	4.1 7.6	3.1 5.7	2.0 3.8	1.0 1.9	
15,000	8.3 23.4	7.4 21.0	6.7 18.7	5.8 16.4	5.0 13.9	4.1 11.7	3.3 9.3	2.5 7.0	1.6 4.6	.8 2.3	
10,000	6.7 23.4	6.0 21.0	5.3 18.7	4.7 16.4	4.1 13.9	3.3 11.7	2.6 9.3	2.0 7.0	1.3 4.6	.6 2.3	

- UPPER FIGURES INDICATE DILUTER LEVER-100% OXYGEN
- LOWER FIGURES INDICATE DILUTER LEVER-NORMAL OXYGEN

Note

- THE DURATION TIME IS DOUBLED WHEN ONLY ONE CREWMEMBER IS USING OXYGEN
- DURATION FIGURES BASED ON OXYGEN REQUIREMENT RATES GIVEN IN MIL-D-19326E.
- OXYGEN DURATION INCREASES AS COCKPIT ALTITUDE INCREASES BECAUSE THERE IS LESS AMBIENT PRESSURE ACTING UPON THE LUNGS AT ALTITUDE THAN AT SEA LEVEL. THEREFORE, A SMALLER QUANTITY OF OXYGEN AT ALTITUDE WILL EXPAND THE LUNGS TO THE SAME SIZE THAT THEY WERE AT SEA LEVEL.

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Figure 1-26

positive pressure to test the face mask for leaks.

Oxygen Flow Indicators

An oxygen flow indicator in each cockpit alternately shows black and white with each breath indicating oxygen flow.

Oxygen Pressure Gages

An oxygen pressure gage indicates oxygen supply pressure in pounds per square inch. The gage is calibrated from 0 to 500 psi.

OXYGEN QUANTITY GAGE

An oxygen quantity gage in each cockpit has a range from 0 to 10 liters. Loss of electrical power to either indicator is indicated by appearance of a power off flag on the instrument face.

Oxygen Quantity Gage Test Button

The oxygen quantity gage test button is on the left vertical panel adjacent to the oxygen quantity gage in the front cockpit. The button is used to test operation of the front and rear cockpit gages along with operation of the oxygen low warning system. With the button pressed, both gage needles should rotate from the current oxygen quantity indication to an indication of zero. As the pointer in the front cockpit passes through the 1 liter indication, the OXYGEN LOW warning light on the front telelight panel should illuminate, and remain illuminated until the pointer again rotates above 1 liter. After releasing the button, both gage pointers return to an indication of current oxygen quantity and the OXYGEN LOW warning light goes out when the front indicator indicates above 1 liter.

OXYGEN SUPPLY

Breathing oxygen can be supplied to the face mask by the pressure demand regulator or the emergency oxygen storage bottle on the ejection seat. Under normal operation, oxygen is converted from a liquid state to a gaseous state. The gaseous oxygen is then routed to the

console mounted pressure demand regulator. The regulator will then supply oxygen upon demand at low altitudes, or under pressure at high altitudes. In the event of a failure of the main oxygen supply system, a limited amount of oxygen can be obtained from the emergency oxygen storage bottle. When the emergency oxygen manual release knob is pulled, either manually or automatically upon ejection, oxygen is released. The oxygen supply system has a normal and an emergency flow. See figure 1-27 for comparison of normal and emergency flow. Resistance to exhalation is noted when using oxygen in the emergency flow mode. This is caused by a back pressure build up of the oxygen being delivered to the face mask once inhalation has ceased. This condition can be alleviated by spilling oxygen out of the side of the mask.

EJECTION SEAT

The ejection seat provides three ejection sequences from the aircraft in an emergency: (1) Dual ejection initiated from the front cockpit, (2) dual ejection initiated from the rear cockpit, and (3) single ejection of the rear crewmember initiated from the rear seat. Refer to Section III for ejection limitations.

EJECTION SEAT COMPONENTS

Refer to Ejection Seat foldout illustration.

Face Curtain Ejection Handle

The face curtain ejection handle is at the top of the seat projecting forward. A forward or downward pull of about 60 pounds releases the handle and about 10 inches of travel is required to initiate ejection. After canopy jettison, an additional pull of about 3 inches will fire the ejection gun. Sitting height should be adjusted to allow the face curtain to be pulled over the helmet without interference.

Lower Ejection Handle

The lower ejection handle is on the front of the seat between the crewmember's legs. An upward pull (45 pounds maximum) and about 1 inch travel initiates ejection. After canopy jettison, an additional pull of about 5 inches will fire the ejection gun.

Lower Ejection Handle Guard

With the guard up, the lower ejection handle cannot be pulled. With the guard down, the handle is unlocked.

Canopy Interlock Block.

The canopy interlock block and associated canopy interlock cable and interdictor link safety pin assembly prevent the face curtain or lower ejection handle from firing the seat until after canopy jettison. On the ground, with the canopy near fully open, the canopy cannot be jettisoned.

Command Selector Valve Handle

The command selector valve handle is above and left of the rear cockpit instrument panel (see Rear Cockpit Foldout Illustration). See figure 1-28. It selects single or dual ejection initiated by the rear crewmember. With the handle vertical (closed), single ejection is selected and the rear crewmember ejects himself. With the handle horizontal (open), both the pilot and rear crewmember will be ejected when either initiates ejection. Two types of valves are installed. For the valve labeled PLT EJECT PULL TURN, to select dual ejection, pull the handle out without applying torque. The handle will rotate clockwise to horizontal. If released at an intermediate position, this handle will return to the vertical (single ejection) position. For the valve labeled PLT EJECT TURN, to select dual ejection, rotate the handle clockwise to horizontal. If released at an intermediate position, this handle may go to either the vertical or horizontal position.

Shoulder Harness Inertia Reel

The shoulder harness reel has an inertia lock which operates as a function of shoulder strap payout velocity. If this velocity is excessive, the reel locks and restrains the crewmembers. The inertia reel can be manually locked. A gas powered system retracts and locks the shoulder harness during ejection.

NOTE

Some aircrew members may have difficulty in reaching/activating some normal and/or emergency controls with the inertia reel in the locked position.

Shoulder Harness Release Handle

The shoulder harness release handle is on the left side of the ejection seat. The forward position locks the inertia reel and the rear position unlocks it. The unlocked position will not prevent automatic lock if strap payout velocity is excessive. Once automatically locked, the handle must be cycled forward and aft to unlock the reel.

Leg Restraints

The leg restraints hold the crewmember's legs against the front of the seat during ejection to prevent flailing. The leg restraints use two garters on each leg (figure 1-29). The garter with the double ring (calf garter) is worn above the flight boot. The garter with the single ring (thigh garter) is worn above the knee. Each garter should be buckled with the quick release on the inside of the leg. After the garter is adjusted, press and secure the loose end. Each leg restraint line is attached to the cockpit floor and passes through a snubber on the front of the seat, routed (without twists) through the calf garter outboard ring, through the inboard ring and then through the thigh garter ring. The lockpin on the end of the line is then inserted in the snubber box. A ring on the snubber box permits adjustment of slack in the restraint line by pulling on the ring and pulling the line forward through the snubber.

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NORMAL PROCEDURES

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NOTE

The aircrew procedures through the Before Taxiing paragraph are separated into individual procedures for the pilot and weapon system officer. These separate procedures allow the individual crewmember to perform the checks without requiring him to read the checks performed by the other crewmember. The remaining procedures are combined and are coded for applicable crewmember action. Items coded (P-WSO) are applicable to both the pilot and weapon system officer. Items coded (WSO) are applicable to the weapon system officer only, and items not coded are applicable to the pilot only.

PREPARATION FOR FLIGHT

FLIGHT RESTRICTIONS

Refer to section V, Operating Limitations, for detailed aircraft and engine operating limitations.

FLIGHT PLANNING

Refer to Performance Data, appendix A.

TAKEOFF AND LANDING DATA CARD

If the takeoff distance exceeds one-half of the available runway length, the takeoff and landing data card in the Aircrew's Checklist should be completed.

WEIGHT AND BALANCE

For maximum gross weight limitations, refer to section V, Operating Limitations. For aircraft loading information, refer to Performance Data, appendix A, and to the handbook of Weight and Balance Data, TO 1-1B-40.

PREFLIGHT CHECK

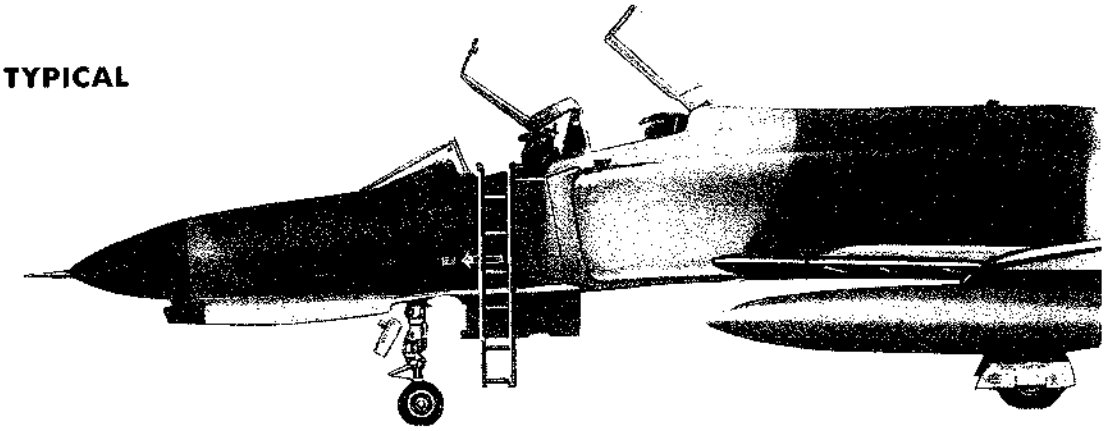
CAUTION

Do not use the retractable boarding steps when the AN/AVQ-23A target designator pod is installed in the left forward missile well.

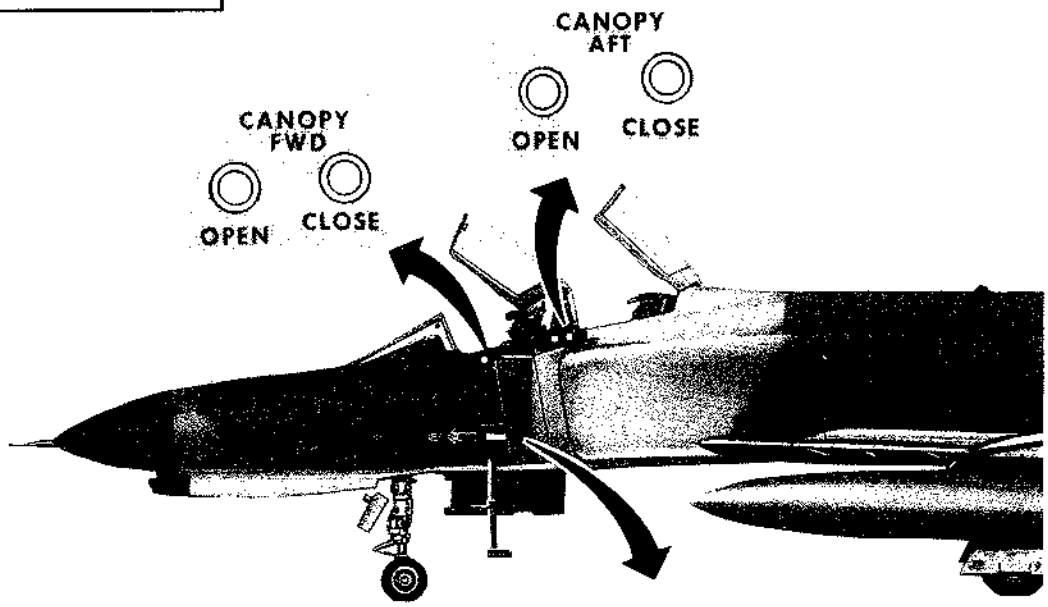
1. Check Form 781 for aircraft status and release.
2. Confirm ejector cartridges installed as required.

COCKPIT ENTRY

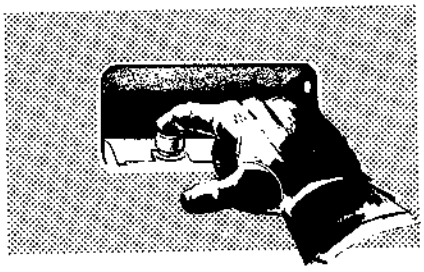
TYPICAL



THE CANOPIES ARE OPENED BY PRESSING THE BUTTON LOCATED BELOW EACH CANOPY



THE BOARDING STEPS ARE RELEASED BY DEPRESSING THE BUTTON INSIDE OF BOTTOM KICK STEP



4E-1-(57)

Figure 2-1

67. APU system – CHECK (some aircraft, (cannot be performed when a battery start is made)
    a. APU reject switch – TEST (APU light on)
    b. Move control stick very slightly fore and aft and check corresponding stabilator movement

CAUTION

Excessive movement of the control stick will cause failure of the PC–2 reservoir.

    c. APU reject switch – NORMAL (APU light out after 1 minute)

68. Oxygen quantity gage – CHECK (cannot be performed when battery start is made)

Check that the oxygen quantity is sufficient for the intended mission, the OFF flag on the gage face is not visible, and the OXYGEN LOW light is extinguished. Press oxygen test button and check OXYGEN LOW light and MASTER CAUTION light illuminate at 1 liter. Notify rear crewmember, if applicable, that test is in progress.

69. Oxygen supply system – CHECK AND SET

Pressure – 65–120 psi
Regulator – CHECK
    a. Oxygen supply lever – FULLY ON
        On the CRU–73A regulator, it is possible for the oxygen supply lever to stop in an intermediate position between OFF and ON. Assure the lever is all the way on.
    b. Emergency lever – NORMAL
    c. Put mask on

Indicator – CHECK
    a. Diluter lever – 100%
    b. Emergency lever – EMERGENCY
    c. Oxygen flow – CHECK
        Breath normally for three cycles and check flow indicator operation. Hold breath; all flow should stop and the indicator should show no–flow (black). A white indicator indicates a leak that must be corrected before flight.
Connections – CHECK
Emergency oxygen – CHECKED
    a. Pressure – CHECKED
    b. Actuation knob and linkage – CHECKED

WARNING

For regulators other than the CRU–73/A, if the oxygen supply lever is OFF and the diluter lever is in NORMAL, there will be no restriction to breathing but the crewmember will be breathing cockpit air only and hypoxia will occur as cockpit altitudes that require oxygen are reached. It is therefore imperative to check for oxygen flow prior to takeoff. With the diluter lever in 100%, if the oxygen supply lever is OFF, neither cockpit air nor oxygen is available at the mask. For the CRU–73A regulator, with the oxygen supply lever OFF, neither cockpit air nor oxygen is available at the mask regardless of diluter lever position.

70. RWR system – CHECK (as required) THEN OFF (cannot be performed when battery start is made)
    Refer to TO 1F–4E–34–1–1.
71. Eject light – CHECK

BEFORE STARTING ENGINES

1. Seat pins – CHECK REMOVED AND STOWED
2. CNI switch – ON
   Have ground personnel place the CNI switch in the left wheel well to the ON position.

CAUTION

When the CNI equipment is operating on external power without cooling air applied, it is limited to 10 minutes of accumulated operation in a 1 hour period in order to prevent heat damage to the equipment.

3. Fore and aft area – CLEAR
   Ensure the wheels are chocked and the engine intake, and exhaust areas, starter exhaust areas, and cockpit and canopy rail areas are clear of personnel and equipment. Refer to Danger Areas Illustration, this section.
4. Fire guard – POSTED
5. Throttles – OFF

CAUTION

Attempting a pneumatic start with throttles out of OFF will result in fuel puddling and the possibility of a hot start or fire.

STARTING ENGINES

The engines can be started by utilizing electrical power from an external power source or the aircraft battery, and by utilizing air pressure from a ground cart or a pyrotechnic cartridge. As a result, several starting combinations can be realized; i.e., external power source and ground cart, external power source and cartridge, battery and cartridge, and battery and ground cart. Refer to section VII, System Operation, for a description of engine starter operation. This procedure establishes the right engine as being started first. This procedure was adopted in order to ascertain that both utility hydraulic system pumps are operating properly. The right engine pump delivers 2775 $\pm$225 psi at idle, while the left engine pump delivers 3000 $\pm$250 psi at idle. Because of this, the single needle utility hydraulic pressure indicator cannot be used to determine pump operation unless the right engine is started first. As the left engine is started, the utility hydraulic pressure will increase slightly indicating the left engine pump is operating. This procedure is based upon external power being available. During a start in which battery power is used, the oil pressure indicator, fuel flow indicator, and hydraulic pressure indicator will not be operative until airplane generated power is available. Cold weather procedures, section IX are to be used any time the initial pressure exceeds 50 psi. This can occur when the outside temperatures are not extremely cold.

WARNING

Under no circumstances will the aircraft be flown with unfired cartridges in the starter.

CAUTION

During engine start, if rpm increases rapidly from 0 to 30%, immediately abort the start. Such an rpm increase is an indication of failure within the starter–to–engine drive train. Further rotation of the engine is impossible with such a failure. Continued fuel flow to the engine under this condition may result in engine fire.

NOTE

If irritating noxious exhause fumes are present, increasing engine(s) to 70% rpm, may reduce fume levels.

PNEUMATIC START

CAUTION

Do not make a pneumatic start with an unfired cartridge installed in the starter. The cartridge may ignite and the resulting added torque may shear the starter output shaft.

1. External air source – CONNECT TO RIGHT STARTER (MA–1A starting unit or equivalent).
2. Engine master switches – ON
3. Engine – CRANK
   Signal ground crew to start external airflow and monitor the tachometer for the first indication of engine rotation.

CAUTION

If there is no indication of engine rpm within 15 seconds or no indication of oil or hydraulic pressure within 30 seconds after external air is applied discontinue the start and investigate.

4. At 10% rpm, ignition button – PRESS AND HOLD WHILE ADVANCING THROTTLE
   Depress the ignition button and simultaneously advance the throttle to a position halfway up the throttle quadrant, then snap the throttle to IDLE while monitoring fuel flow. If the fuel flow drops below 225 pph (400 pph, low smoke engine), the throttle rigging is out of limits and an entry shall be made in the Form 781. Do not accept the aircraft for flight where a snap deceleration is anticipated as flameout may occur. Rear crewmember will check for appropriate throttle movement during start. If throttles are not engaged, reconnect after engine start.

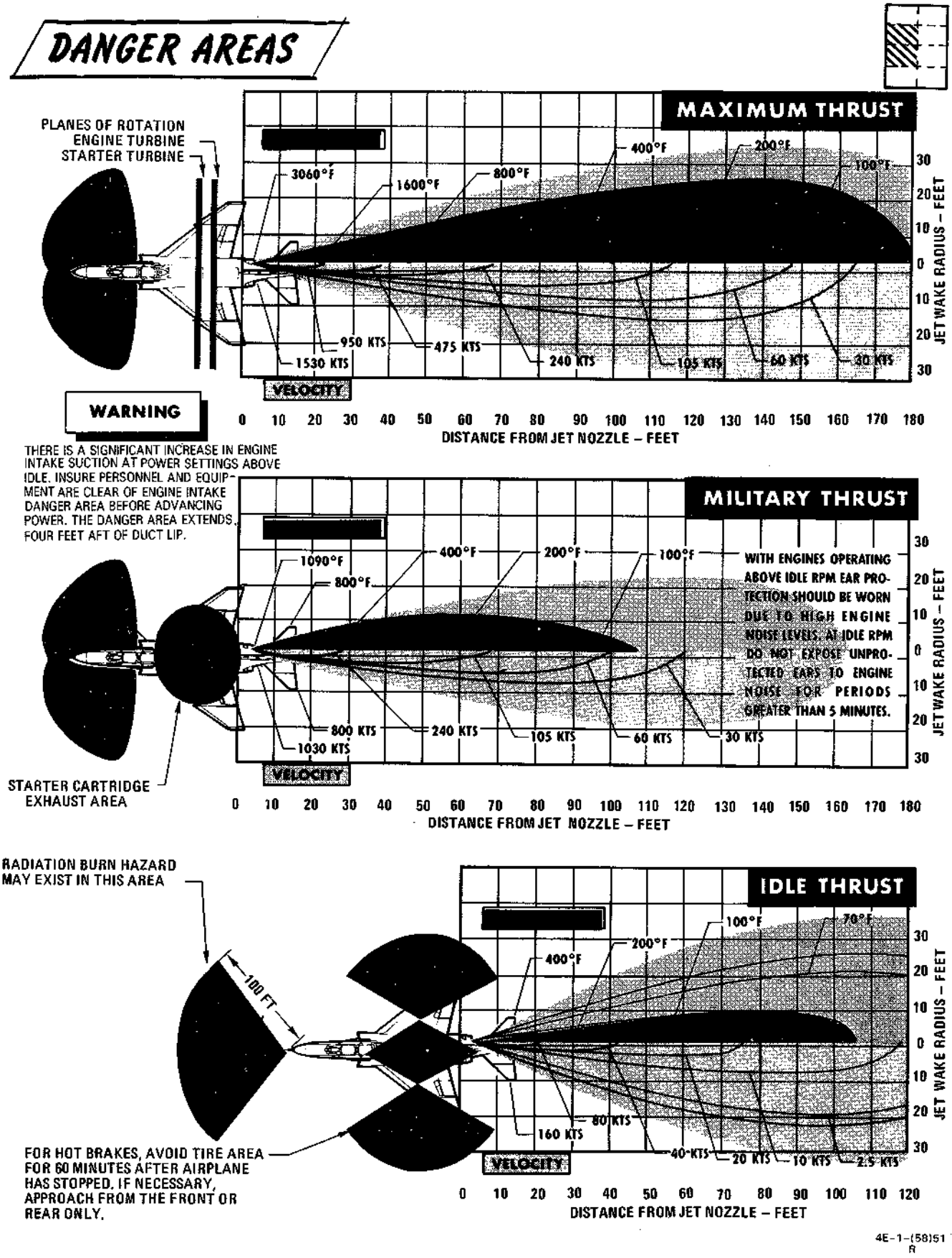

DANGER AREAS
MAXIMUM THRUST
PLANES OF ROTATION
ENGINE TURBINE
STARTER TURBINE
3060°F
1600°F
800°F
400°F
200°F
100°F
950 KTS
475 KTS
1530 KTS
240 KTS
105 KTS
60 KTS
30 KTS
VELOCITY
WARNING
THERE IS A SIGNIFICANT INCREASE IN ENGINE INTAKE SUCTION AT POWER SETTINGS ABOVE IDLE. INSURE PERSONNEL AND EQUIPMENT ARE CLEAR OF ENGINE INTAKE DANGER AREA BEFORE ADVANCING POWER. THE DANGER AREA EXTENDS FOUR FEET AFT OF DUCT LIP.
MILITARY THRUST
1090°F
800°F
400°F
200°F
100°F
WITH ENGINES OPERATING ABOVE IDLE RPM EAR PROTECTION SHOULD BE WORN DUE TO HIGH ENGINE NOISE LEVELS. AT IDLE RPM DO NOT EXPOSE UNPROTECTED EARS TO ENGINE NOISE FOR PERIODS GREATER THAN 5 MINUTES.
800 KTS
1030 KTS
240 KTS
105 KTS
60 KTS
30 KTS
VELOCITY
STARTER CARTRIDGE EXHAUST AREA
RADIATION BURN HAZARD MAY EXIST IN THIS AREA
100 FT
IDLE THRUST
100°F
70°F
200°F
400°F
80 KTS
160 KTS
40 KTS
20 KTS
10 KTS
2.5 KTS
VELOCITY
FOR HOT BRAKES, AVOID TIRE AREA FOR 60 MINUTES AFTER AIRPLANE HAS STOPPED. IF NECESSARY, APPROACH FROM THE FRONT OR REAR ONLY.
JET WAKE RADIUS – FEET
DISTANCE FROM JET NOZZLE – FEET
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
30 20 10 0 10 20 30
4E-1-(58)51 R

Figure 2-3

CAUTION

Do not attempt to start the engine before reaching 10% rpm. If the starting procedure is initiated at a lower rpm additional heat distress of the engine hot section is anticipated. Overtemperature of the turbine will generally occur during a low rpm start if starter air is inadvertently interrupted during the start cycle.

5. Release ignition button as soon as lightoff is indicated.
   Lightoff is indicated by a rise in exhaust gas temperature followed by an increase in engine rpm. Engine lightoff is usually noted at approximately 13 to 16% rpm with a fuel flow of 225 to 750 pounds per hour (400 to 1,200 pounds per hour, low smoke engine). Higher fuel flow values are likely to result in hot starts. To prevent an overtemperature condition from occurring, the engines should be shut down prior to reaching the actual EGT limit. In the event of a hot or false start, and the throttle cannot be returned to OFF, the engine may be shutdown from any throttle setting by placing its engine master switch OFF (provided the other master switch is ON, if a battery start is made). This closes the fuel shutoff valve and deprives the engine of fuel. The engine will flameout in approximately 30 seconds from idle and approximately 2 seconds from military. After a wet or false start, allow 1 minute or longer for the combustion system to drain while continuing to turn the engine with pneumatic air. Direct the crew chief to inspect the engine nozzle for residual fuel before restarting the engine. If the engine does not light off within 15 seconds after fuel flow is indicated, discontinue the start and investigate. If the engine does not continue to accelerate after light off, discontinue the start.
6. At 45% rpm, signal ground crew to stop external airflow
7. Exhaust gas temperature indicator – 220° to 420°C (250° to 540°C, low smoke engine)
8. Fuel flow indicator – WITHIN LIMITS
   Fuel flow should not exceed 750 pph at lightoff, and 800 to 1400 pph at idle. For low smoke engines, fuel flow should not exceed 1,200 pph at lightoff, and 800 to 1,500 pph at idle. Fuel consumed during starting is approximately 65 pounds per engine.
9. Idle rpm – 65 ±1%
10. Right boost pump indicator – 30 ±5 PSI (some aircraft)
11. Oil pressure indication – 12 PSI MIN 50 PSI MAX
12. Hydraulic pressure indicators – WITHIN LIMITS
    With the right engine started, the PC-2 hydraulic pressure indicator should read 3000 ±250 psi and the utility hydraulic pressure indicator should read 2775 ±225 psi. The check hydraulic gage indicator light remains illuminated until the left engine is started and all four hydraulic pumps are operating above 1750 psi. When the left engine is started, the utility hydraulic pressure indicator should read 3000 ±250 psi.

CAUTION

With only one engine operating, excessive rapid movement of the control stick may rupture the inoperative power control system reservoir.

13. Right generator switch – GEN ON
    Ensure RH GEN OUT and BUS TIE OPEN lights go out. On aircraft without DMAS or NWDS, to avoid an electrical power interruption which could result in an INS No-Go indication, the pilot should ensure that INS is not in the align mode when the generator switches are placed to GEN ON.

WARNING

Check that auxiliary air doors and speed brakes (if out) are clear prior to cycling generator switches. Any interruption in electrical power will cause them to close violently, with possible injury to ground crew personnel.

NOTE

On NWDS aircraft, to avoid electrical power transients move the generator switch from EXT to ON with no pause in the OFF position.

14. APU light – CHECK ON (some aircraft)
    The APU light will remain illuminated for approximately 1 minute after the left engine is started.
15. Spoiler actuator – CHECK
    With the right engine operating, slowly deflect control stick approximately 1 inch to the left. Have ground crew or rear seat occupant verify that the spoiler does not fully deflect and that it returns to a flush position when the stick is returned to neutral. Abort if the spoiler check is not good.
16. Air refueling door and exterior air refueling lights – CHECK (if required).
17. Start the left engine per steps 1 through 12, substituting LEFT in all cases.
18. Left generator switch – GEN ON
    Ensure that the LH GEN OUT light goes out. If the BUS TIE OPEN light does not go out within approximately 18 seconds, accelerate either

engine to approximately 70% rpm and cycle right generator. In low ambient temperatures, the BUS TIE OPEN light may not immediately go out after the left engine is started and the left generator light goes out. This may be due to failure of the generators to synchronize quickly because of cold oil in the left generator CSD.

19. Right generator switch - CYCLE
    Cycle the right generator switch (OFF, then GEN ON), and check that the RH GEN OUT light illuminates.

WARNING

Do not cycle both generator switches at once. Any interruption in electrical power will cause the auxiliary air doors and the speed brakes (if out) to close violently, with possible injury to ground crew personnel.

20. BUS TIE OPEN light - OUT
    Ensure that the BUS TIE OPEN light remains out when placing the right generator switch to OFF, and that it flashes on momentarily when the switch is returned to the GEN ON position.
21. External air - DISCONNECT
22. External electrical power - DISCONNECT
23. Interior check - COMPLETE (if applicable)

ENGINE GROUND OPERATION

No engine warm-up is necessary; however, allow the engines to operate at idle until instrument readings stabilize. As soon as instrument readings stabilize, the throttle may be advanced to maximum thrust.

BEFORE TAXIING (FRONT COCKPIT)

NOTE

Since pressure vibrations in some types of shelters may cause instrument fluctuations and/or inaccurate readings, the Before Taxiing checks should be performed outside the shelter when practical.

1. Anti-G suit system - CHECK
   Press and release manual inflation button on anti-G suit control valve. Check for proper suit inflation and deflation.
2. Communication and navigation equipment - ON AND CHECK
3. IFF - STANDBY
   Prior to this point the IFF should remain OFF as any interruption of power would cause loss of the mode 4 code.
4. Radar altimeter - ON
   Before TO 1F-4-1252, check that OFF flag moves out of view.
5. Altimeter and SPC - SET AND CHECK
   a. Set current altimeter setting on the barometric scale.
   b. Altimeter pointer should indicate the field elevation within ±75 feet.
   c. Place the SPC switch to RESET CORR. The STATIC CORR OFF light should go out and remain out. Disregard initial momentary engagement oscillations. Altimeter reading after oscillations stop should not exceed ±25 feet from original reading. Continued altimeter oscillations of any magnitude are unacceptable.

NOTE

Failure of the STATIC CORR OFF light to extinguish after SPC engagement could be an indication of CADC failure and the mission should be aborted.

   d. With the static correction on (SPC engaged), the altimeter should indicate the field elevation within ±90 feet.
   e. The difference between the front and rear cockpit altimeters should not exceed 100 feet.
   f. Place the altimeter switch to RESET. Altimeter should not vary more than ±75 feet and the red STBY flag should not be in view.
   g. The altimeter should indicate the field elevation within ±75 feet.
   h. With both altimeters in RESET, the difference between the front and rear cockpit should not exceed 75 feet.

NOTE

If the altimeter is not within tolerance in RESET, the aircraft may be flown in the STBY mode provided that, in the STBY mode, the altimeter checks within ±75 feet of field elevation. The ±75 feet of field elevation is an operational restriction and does not necessarily reflect instrument tolerances.

6. Speed brakes - CYCLE
   Open and close the speed brakes to check proper operation. Have ground crew check that speed brakes extend simultaneously. Obtain a signal from the ground crew that the speed brakes are fully closed and observe that the SPEED BRAKE OUT indicator light is extinguished.
7. Slats flaps - CHECK
   Place slats flaps switch to OUT; observe that slats indicate OUT and flaps indicate DN. The flaps may not extend or retract together without airloads on them. This condition is normal and the flaps should extend and retract together when airborne. Place slats override switch to IN; observe slats retract. Place slats override switch to NORM; observe slats extend. If slats indicate barberpole or indication does not match switch position, leave switch as set and abort the mission. If an audible (noticeable in head phones) chattering associated with slats flaps and utility hydraulic pressure indicators fluctuating in

unison occurs, cycle the slats flaps. If chatter persists, abort the mission. If cycling stops chatter, continue mission and make an appropriate entry in AF Form 781.

CAUTION

Continued or prolonged operation with flap or slat chatter will damage actuator(s) and mechanisms.

8. Flight controls – CHECK (slats flaps OUT AND DOWN)
   Ground crew should confirm all flight control positions. The MASTER CAUTION and CHK HYD GAGES lights may illuminate momentarily during this check. If pressure recovers without delay, disregard this indication.
   a. Pitch trim – 1 TO 3 UNITS NOSE DOWN
   b. Control stick – PULL FULL AFT AND RELEASE
      Movement forward should be smooth and free of any restriction. The stick may not return to the full forward position. The stick should move forward at least to the ½ travel position and further movement toward the stop should require no more than one pound push force. If trim is set full nose down, several slight bumps may be felt during this check. If these bumps do not recur when stabilator is properly trimmed, disregard this indication.
   c. Rudder – CHECK FULL TRAVEL LEFT AND RIGHT

d. Ailerons/ARI — CHECK

Move control stick full left. Observe left spoiler up, right aileron down and rudder slightly left. Engage yaw stab aug. Observe rudder move further left. Depress emergency quick release lever. Observe rudder move toward neutral. Release emergency quick release lever, neutralize stick and disengage yaw stab aug. Repeat check substituting right for left.

9. Slats flaps — NORM
10. ARI disengage – CHECK

Move stick full right and left. Observe no rudder movement.

11. Stab aug switches – ENGAGE AND CHECK

Engage each axis of stab aug individually. Observe no movement of any control surface (¼ inch allowable). If an aileron/spoiler deflects during roll stab aug engagement, it may take up to 4 seconds to resettle after roll stab aug is disengaged. Allow enough time for the aileron/spoiler to resettle before reengaging roll stab aug to check the other aileron/spoiler.

12. Reference system selector – PRIM (ensure INS is in NAV) (W/O DMAS or NWDS)
13. Compass mode control knob – SYNC (if necessary)

Allow 10 seconds for automatic synchronization before manually synchronizing system.

NOTE

Coordinate with the WSO to ensure the NWDS INU alignment is complete. Movement of the aircraft could cause the INU to automatically exit alignment causing the INU to enter ATT mode or degraded NAV mode.

14. Automatic flight control system – CHECK (if required)

a. AFCS – ENGAGE

Grasp stick below stick grip. Position stick near neutral. Hold switch to ENGAGE until AFCS engages. Check that the stick does not immediately drive forward or aft nor any control surface jump more than ½ inch. If the wings are not level, the ailerons will drive due to normal action of the heading hold function. Abruptly move the stick forward or aft and check that AFCS disengages. Reengage AFCS switch.

b. Altitude hold – ENGAGE

Observe no control surface jump or rapid stick motion.

c. AFCS – DISENGAGE

Depress and hold the front cockpit emergency quick release lever. Observe PITCH AUG OFF, AUTOPILOT DISENGAGE and MASTER CAUTION lights illuminate. Release lever. Observe PITCH AUG OFF light goes out.

d. AFCS – ENGAGE

e. (WSO) AFCS – DISENGAGE

Depress and hold the rear cockpit emergency quick release lever. Observe PITCH AUG OFF, AUTOPILOT DISENGAGE and MASTER CAUTION lights illuminate. Release lever. Observe PITCH AUG OFF light goes out.

NOTE

Ground checks cannot ensure an operational AFCS inflight. If AFCS does not engage during ground checks or fails ground checks, do not use during flight.

15. Stab aug switches – DISENGAGE
16. Trim – CHECK AND SET 1 TO 3 UNITS NOSE DOWN

With 3 units nose down trim, expect a nose heavy tendency on the takeoff roll which quickly approaches a trimmed condition as the aircraft lifts off and the gear and flaps are retracted. With 1 unit nose down trim, a very marked nose up trim occurs after approximately 230 knots requiring a large nose down trim change at a very low altitude. Check operation of the trim indicator. Receive a signal from the ground crew/rear cockpit occupant that the ailerons and rudder are set at neutral.

17. Slats flaps – OUT AND DOWN (ground crew visually check)
18. Optical sight – STBY, OR CAGED
19. Pneumatic pressure – CHECK
20. IFF – CHECK
21. Radar altimeter – CHECK

Before TO 1F-4-1252:

Allow 5 minutes warm-up after radar altimeter turned on.

a. Function control switch – PRESS

Check that pointer moves to 35± 15 feet and stabilizes.

b. Low altitude warning light – CHECK

With function control switch pressed, move reference marker above and below pointer. Warning light must come on with ±5 feet of indicated altitude.

c. Function Control Switch – RELEASE

Move reference marker to below 5 feet. Check that warning light is off and altitude pointer fluctuates.

d. Reference marker – SET

Set to desired low altitude limit.

After TO 1F-4-1252:

Allow up to 30 seconds for Automatic Self Test (AST) to align.

a. VALI — SET TO 400 FEET
b. Set knob — PRESS

The needle will drive to 500 feet, the digital display will show 88888, and the R/T lamp will light. After 1.5 seconds, the needle will drive to 300 feet, the digital display will show 300 ±10 feet, the R/T lamp will go out, and the LO lamp will go on.

22. Wheel chocks and ground interphone cord — REMOVED

NOTE

Do not move aircraft with INS in ALIGN mode.

BEFORE ENTERING REAR COCKPIT

1. Canopy condition - CHECK
   Check for cracks in the canopy and windshield plexiglass. Check condition of the canopy pressure seals. Ensure canopy knife present and secure.
2. Canopy safety strut - REMOVED
   Ensure normal canopy control handle is in open position if safety strut requires removal.
3. Canopy actuator - SHEAR PIN INTACT
4. Lower ejection handle guard - UP

WARNING

No object of any kind should ever be placed on the top of the ejection seat.

5. Command selector valve - VERTICAL
6. Ejection seat - CHECK
   a. Face curtain and seat mounted initiator safety pins - INSTALLED; ALL OTHER SAFETY PINS REMOVED

CAUTION

Exercise caution regarding hand movements in the vicinity of the bulkhead mounted canopy initiator linkages. Also, do not stow flight equipment or personal items in this area. Failure to comply could result in inadvertent jettisoning of the canopy.

   b. Canopy interlock cable and interdictor link safety pin assembly - INSTALLED CORRECTLY AND ATTACHED TO CANOPY

WARNING

If the canopy interlock cable and interdictor link safety pin assembly is pulled or bypassed and the sear pulled, the seat will fire immediately.

   c. Banana links - ENGAGED IN MAIN SEAR
   d. Drogue chute retaining flaps - FORWARD FLAP FOLDED OVER OTHER FLAPS
   e. Seat mounted initiator - LINKAGE CONNECTED
   f. Scissors - LOCKED TO SHACKLE AND TIED DOWN, SCISSORS GUARD NOT BROKEN

WARNING

If the scissors shackle safe-tie thread passes through the wire loop, the drogue chute may not deploy.

   g. Drogue chute withdrawal line - ROUTED OVER ALL OTHER LINES
   h. Top latch mechanism plunger and locking indicator - FLUSH WITH HOUSING

WARNING

If the plunger and locking indicator are not flush with the housing, the seat is not locked in position and an inadvertent ejection can occur.

   i. Personnel parachute withdrawal line — QUICK DISCONNECT IS CONNECTED AND RUNS THROUGH GUILLOTINE
   j. Personnel parachute safety pin line — NOT THROUGH GUILLOTINE
   k. Parachute alignment ring — SAFETY PIN LINE AND RIPCORD PIN LINE (ATTACHED TO PARACHUTE WITHDRAWAL LINE) ROUTED THROUGH, PARACHUTE WITHDRAWAL LINE ROUTED AROUND
   l. Check security of parachute container — PARACHUTE CONTAINER SHOULD NOT MOVE MORE THAN 1 INCH
   m. Guillotine — CHECK PASSAGE AND HOSE SECURITY
   n. Drogue gun assembly — SHEAR PIN INTACT, SAFETY PIN OUT, TRIP ROD CONNECTED WITH NO RED SHOWING ON INNER BARREL
   o. Drogue gun cocking indicator — COCKED (some aircraft)
      If the indicator is approximately 1/2 inch below the gun housing, it is cocked. If flush with the housing, it is uncocked and will not fire on ejection.
   p. Rocket motor initiator — CHECK SEAR ENGAGED, SAFETY PIN REMOVED, ACTUATION LANYARD CONNECTED, HOSE ASSEMBLY CONNECTED AND PIN INSTALLED, AND TRIP ROD CABLE CONNECTED
   q. Bulkhead mounted canopy initiator — LINKAGE CONNECTED, SAFETY PIN REMOVED
   r. Harness assembly — CHECK
      Ensure that parachute container holddown straps are routed in front of the backpad

WARNING

If the holddown straps are hooked or routed behind the back pad, or hooked behind the emergency oxygen bottle, interference with parachute deployment will occur.

   s. Emergency oxygen — PRESSURE AND SAFETY PIN REMOVED
      Proper servicing of the emergency oxygen bottle is indicated by a gage reading of 1800–2200 psi at 21°C (70°F). The pressure indication varies with temperature. To determine correct indication, add 6.5 psi for each degree above 21°C (3.5 psi/°F) and subtract 6.5 psi for each degree below 21°C. Thus, the bottle is correctly serviced if the gage reads 1890–2290 psi at 35°C (95°F). See ejection seat foldout illustration for approximate pressure values for various gage needle locations.

t. Emergency oxygen actuation knob and linkage - CHECK
   Check knob not actuated. If actuated, knob is tilted approximately 45° from vertical. Check security of shear pin in cable to linkage connection by applying light tension on cable.
u. Leg guards — IN PLACE
v. Leg garters - LOCKED IN, AND LANYARDS NOT TWISTED
w. Survival kit - RELEASE HANDLE DOWN, SELECTOR SWITCH AUTO POSITION (UP)
x. Emergency harness release handle - DOWN WITH SEAR ENGAGED, SAFETY PIN OUT, AND ACTUATION LANYARD CONNECTED
y. Time release trip rod - CONNECTED
z. Personnel locator beacon (PLB) inflight mode selector switch - AUTOMATIC POSITION (RED DOT SHOWING) FOR NORMAL PEACETIME OPERATIONS. SAFETY STREAMER REMOVED.
aa. Time release mechanism — CHECK BAROSTAT HOLES UNBLOCKED

BEFORE ELECTRICAL POWER (REAR COCKPIT)

1. AN/ALE-40 chaff dispenser - OFF
   If either the chaff or flare CCU control knob is out of the OFF position and a programmer malfunction occurs, flares or chaff could be dispensed if the pins are pulled. Therefore, if chaff and/or flares are loaded, it is important that the CCU control knobs remain in the OFF position until airborne for peacetime or remain OFF until immediately prior to takeoff for wartime operations.
   a. Chaff mode switch - OFF
   b. Flare mode switch - OFF
   c. Ripple switch - OFF
2. Throttles - AFT
3. UHF radio - OFF
4. AVTR switch - OFF (some aircraft)
5. APX-80 mode switch - PASSIVE/OFF
6. Radar power - OFF

CAUTION

The radar power selector knob should remain OFF until the aircraft is operating on internal power.

7. DSCG - OFF (some aircraft)
8. ECM equipment — OFF (some aircraft
   Refer to TO 1F-4E-34-1-1-1 and TO 1F-4E-34-1-1-2.
9. INS — OFF (some aircraft)
10. Navigational computer set control - SET (some aircraft)
    a. Mode selector knob - AS DESIRED
    b. INS knob - SYS OFF
11. Nuclear store consent switch - SAFE
12. NAV computer — OFF (some aircraft)
13. NWDS power switch — OFF (some aircraft)
14. Battery bypass switch — OFF
15. SST-181X pulse selector switch — OFF
16. Circuit breaker panels — CHECK
17. Electrical test receptacle plug 3P325 — ENSURE PLUG SEATED FLUSH, KNURLED LOCK RING SECURE, CAP TIGHT.
    It is possible to trip both generators off the line if the electrical test receptacle plug 3P325 under the right canopy sill is loose. The plug uses a (twist clockwise to lock) knurled lock ring which should not be confused with the chain equipped threaded cap.
18. Publications and flight data — CHECK

AFTER ELECTRICAL POWER (REAR COCKPIT)

1. Instrument ground power switch — ACTUATE (cannot be performed when battery start is made)
2. TISEO — OFF (some aircraft)
3. Navigation computer — SET (without DMAS or NWDS)
   a. Present position counters — SET
   b. Target counters — SET FOR PRESENT POSITION
   c. Wind counters — SET PREFLIGHT WIND DIRECTION AND SPEED
   d. Variation counter — SET LOCAL MAGNETIC VARIATION
   e. Position update switch — NORM
   f. Function select knob — STBY
   g. INS power control knob — STBY
   h. Function selector knob — RESET
      Coordinates may be stored in the navigation computer by placing the function selector knob to RESET. The coordinates stored in the AN/ASN-46A are those in the target windows.
   i. Function selector knob — TGT1 OR TGT2 AS DESIRED
      With the NAV mode selector switch in BRG-TRACK, set the same present position and target coordinates. The DME on the BDHI for TGT1 or TGT2 should be within 0.0 ±1.5 NM.
   j. Target counters — SET FOR TGT1
4. INS alignment — AS DESIRED (without DMAS or NWDS)
   Navigation accuracy is adversely affected if the aircraft is disturbed during INS alignment.
5. DMAS alignment — AS DESIRED (after TO 1F-4E-626)
   For gyrocompass and rapid reaction alignment procedures, refer to TO 1F-4E-34-1-1-2.

6. NWDS alignment – AS DESIRED (after TO 1F–4E–671)
   For gyrocompass and rapid reaction alignment procedures, refer to TO 1F–4E–34–1–1–3.

WARNING

Verify that an authorized OFP version is displayed on initialization screen. Any version that is not tested can potentially provide erroneous displays, immediate or nonrelease of weapons, and prevent proper INS alignment. Reload the system with version listed on Software Notice page or a version authorized for use by the F–4 System Program Manager.

REAR COCKPIT INTERIOR CHECK

WARNING

All harnessing, personal equipment leads and leg restraint lines must be secured before closing the canopy.

1. Rudder pedals – ADJUST
2. Leg restraint lines – BUCKLED AND SECURE
   Leg garters buckled and properly adjusted with garter releases on the inside of the legs. Lines secure to seat and floor, and not twisted or entangled in rocket motor or rocket motor sear cable. Leg restraint lines threaded through the calf garters (double D–ring), routing first through the outboard ring and then through the inboard ring, then through the thigh garters (single D–ring) before the lock pins are inserted in the snubber boxes. Leg restraint line lock pins threaded through hold–down strap lugs on the survival kit. Survival kit–to–seat retention straps (if incorporated) attached to the leg restraint line lock pins at the lock pin attachment points.

WARNING

- The leg restraint lines must be buckled at all times during flight to insure legs will be pulled back upon ejection. This will enhance seat stability and will prevent leg injury by keeping legs from flailing following ejection.
- Failure to route the restraint lines properly through the garters could cause serious injury during ejection.

3. Harnessing and personal equipment leads – FASTEN
   Attach the parachute riser–shoulder harness fittings to the integrated harness. Attach and firmly adjust the survival kit straps. Secure and firmly adjust the lap belt. Connect oxygen, communication and anti–G leads. Route the anti–G hose line behind personal harness sling if hose interferes with controls on left console. Check the operation of the shoulder harness locking mechanism.

WARNING

Failure to adjust survival kit straps to achieve a snug fit between the crewmember and kit may result in fatal injury during ejection.

4. Ejection seat height – ADJUST (cannot be performed when battery start is made)
5. Face curtain and seat mounted initiator safety pins – REMOVED
   After all personal leads have been fastened, have ground crewmember remove face curtain and seat mounted initiator safety pins, show them to aircrew member before stowing in bag, and hand bag to aircrew member.

WARNING

If the seat mounted initiator safety pin is left installed during flight, seat ejection is not possible. The ejection gun firing linkage will be restrained from moving, thus preventing firing of the ejection gun.

6. Stick grip and boot – CHECK
   Check stick grip firmly attached to stick and stick boot in place with no tears.

7. Communication navigation control panel – SET
   a. Communication frequency control thumbwheels – AS REQUIRED
   b. Communication channel control knobs – AS REQUIRED
   c. Mode select switch – AS REQUIRED (some aircraft)
   d. UHF volume control thumbwheel – AS DESIRED
   e. Auxiliary channel control knob – AS REQUIRED
   f. Auxiliary volume control knob – AS DESIRED
   g. COMM–AUX pushbutton – TR + G – ADF
   h. Navigation channel control knob – AS REQUIRED
   i. Navigation volume control knob – AS REQUIRED
   j. Tacan function selector knob – OFF
   k. Communications command button – AS DESIRED
   l. Navigation command button – AS DESIRED
8. VOR/ILS/marker beacon volume – AS DESIRED (some aircraft)
9. Emergency slats flaps handle – FORWARD
10. Intercom control panel – SET
    a. Volume control knob – AS DESIRED
    b. Amplifier selector knob – NORM
    c. Function selector knob – HOT MIC
11. Emergency gear handle – IN AND SECURE
12. Emergency brake handle – IN AND SECURE
13. Slats flaps position indicators – IN AND UP
14. Landing gear position indicators – GEAR DOWN INDICATION
15. Canopy emergency jettison handle – FORWARD
16. Radar scope – SECURE
    Check that radar scope retaining pins are properly installed.
17. Attitude indicator – CHECK AND SET (cannot be performed when battery start is made)
    a. Rotate pitch trim knob to check travel (−10° to +5°)
    b. Set horizon bar level with miniature aircraft.

WARNING

If the horizon bar will not move with the pitch trim knob, the attitude indicator is unsafe for flight.

18. Clock – WIND AND SET
19. Accelerometer – SET
20. Navigation function selector switch – AS DESIRED
21. Digital display indicator lamp button – PRESS
22. Navigational computer set control lamp button – PRESS
23. KY−28 power selector knob – OFF (some aircraft)
24. KY−28 mode selector – P (some aircraft)
25. KY−58 power switch – OFF (some aircraft)
26. KY−58 mode select knob – P (some aircraft)
27. Canopy manual unlock handle – FORWARD
28. Aural tone – AS REQUIRED
29. Cockpit lights control panel – SET
    a. White floodlight switch – OFF
    b. Instrument panel lights control knob – AS REQUIRED
    c. Console lights control knob – AS REQUIRED
    With the console lights control knob in the OFF position, the radar scope camera green operate light will be inoperative.
    d. Standby compass light switch – AS REQUIRED
    e. Console floodlights switch – AS DESIRED
    f. Indexer lights control knob – AS DESIRED
30. Warning and indicator lights – TEST (cannot be performed when battery start is made)
31. Intercom system – CHECK
32. Oxygen quantity gage – CHECK (cannot be performed when battery start is made)
    Check that the oxygen quantity is sufficient for the intended mission, and the OFF flag on the gage face is not visible.
33. Oxygen supply system – CHECK AND SET

Pressure – 65–120 psi
Regulator – CHECK
   a. Oxygen supply lever – FULLY ON
      On the CRU–73A regulator, it is possible for the oxygen supply lever to stop in an intermediate position between OFF and ON. Assure the lever is all the way on.
   b. Emergency lever – NORMAL
   c. Put mask on
Indicator – CHECK
   a. Diluter lever – 100%
   b. Emergency lever – EMERGENCY
   c. Oxygen flow – CHECK
      Breath normally for three cycles and check flow indicator operation. Hold breath; all flow should stop and the indicator should show no–flow (black). A white indicator indicates a leak that must be corrected before flight.
Connections – CHECK
Emergency Oxygen – CHECKED
   a. Pressure – CHECKED
   b. Actuation knob and linkage – CHECKED

WARNING

For regulators other than the CRU–73/A, if the oxygen supply lever is OFF and the diluter lever is in NORMAL, there will be no restriction to breathing but the crewmember will be breathing cockpit air only and hypoxia will occur as cockpit altitudes that require oxygen are reached. It is therefore imperative to check for oxygen flow prior to takeoff. With the diluter lever in 100%, if the oxygen supply lever is OFF, neither cockpit air nor oxygen is available at the mask. For the CRU–73A regulator, with the oxygen supply lever OFF, neither cockpit air nor oxygen is available at the mask regardless of diluter lever position.

34. RWR systems – CHECK (as required) THEN OFF (cannot be performed when battery start is made)

BEFORE TAXIING (REAR COCKPIT)

NOTE

Since pressure vibrations in some types of shelters may cause instrument fluctuations and/or inaccurate readings, the Before Taxiing checks should be performed outside the shelter when practical.

1. Interior check – COMPLETE (battery start)
2. Anti-G suit system – CHECK
   Press and release inflation button on anti-G suit control valve. Check for proper suitinflation and deflation.
3. Communication and navigation equipment – ON & CHECK
4. Target designator – POWER ON AND STOWED (some aircraft)
5. Tiseo – ON (some aircraft)
6. Radar BIT checks – INITIATE
7. WRCS BIT checks – INITIATE (some aircraft)
8. ECM Pod – AS REQUIRED
9. Navigation computer function selector knob – AS REQUIRED (some aircraft)
   a. Steer knob – AS DESIRED
   b. Coord knob – AS DESIRED
   c. Data knob – AS DESIRED
10. Keyer control – SET (with DMAS)
11. NWDS CDU – MISSION DATA ENTERED AND SET (as required) (some aircraft)
12. Altimeter – SET AND CHECK
    a. Set current altimeter setting on the barometric scale.
    b. Altimeter pointer should indicate the field elevation within ±75 feet.
    c. With the SPC switch at RESET CORR, the STATIC CORR OFF light should go out and remain out. Disregard initial momentary engagement oscillations. Altimeter reading after oscillations stop should not exceed ±25 feet from original reading. Continued altimeter oscillations of any magnitude are unacceptable.

NOTE

Failure of the STATIC CORR OFF light to extinguish after SPC engagement could be an indication of CADC failure and the mission should be aborted.

    d. With the static correction on (SPC engaged), the altimeter should indicate the field elevation within ±90 feet.
    e. The difference between the front and rear cockpit altimeters should not exceed 100 feet.
    f. Place the altimeter switch to RESET. Altimeter should not vary more than ±75 feet and the red STBY flag should not be in view.
    g. The altimeter should indicate the field elevation within ±75 feet.
    h. With both altimeters in RESET, the difference between the front and rear cockpit should not exceed 75 feet.

NOTE

If the altimeter is not within tolerance in RESET, the aircraft may be flown in the STBY mode provided that, in the STBY mode, the altimeter checks within ±75 feet of field elevation. The ±75 feet of field elevation is an operational restriction and does not necessarily reflect instrument tolerances.

13. INU – NAVIGATE (some aircraft)
    When the INU has completed a satisfactory alignment (with NAV READY displayed in normal video) the WSO should press the ⊟▸ switch on the CDU followed by a valid destination number, followed by ENT, or press the A key to advance the system to the first destination, to place the INU in navigate mode.

TAXIING

1. Wheel brakes – TEST
   After initial roll, apply the wheel brakes to check their operation.
2. Nose gear steering – ENGAGE AND CHECK
   Engage nose gear steering and actuate in both directions to ensure proper operation.

CAUTION

- Taxi with canopies full open or full closed; with the canopies open, maintain taxi speeds below 60 knots to prevent damage to the canopy operating mechanism.
- Adequate distance between aircraft must be maintained during formation taxi. An open canopy may be damaged by engine exhaust blast.
- While taxiing during high gross weight conditions, the turning radius should be increased and speed reduced to minimum practical to relieve excessive side loads on the main landing gear struts, wheels, and tires.

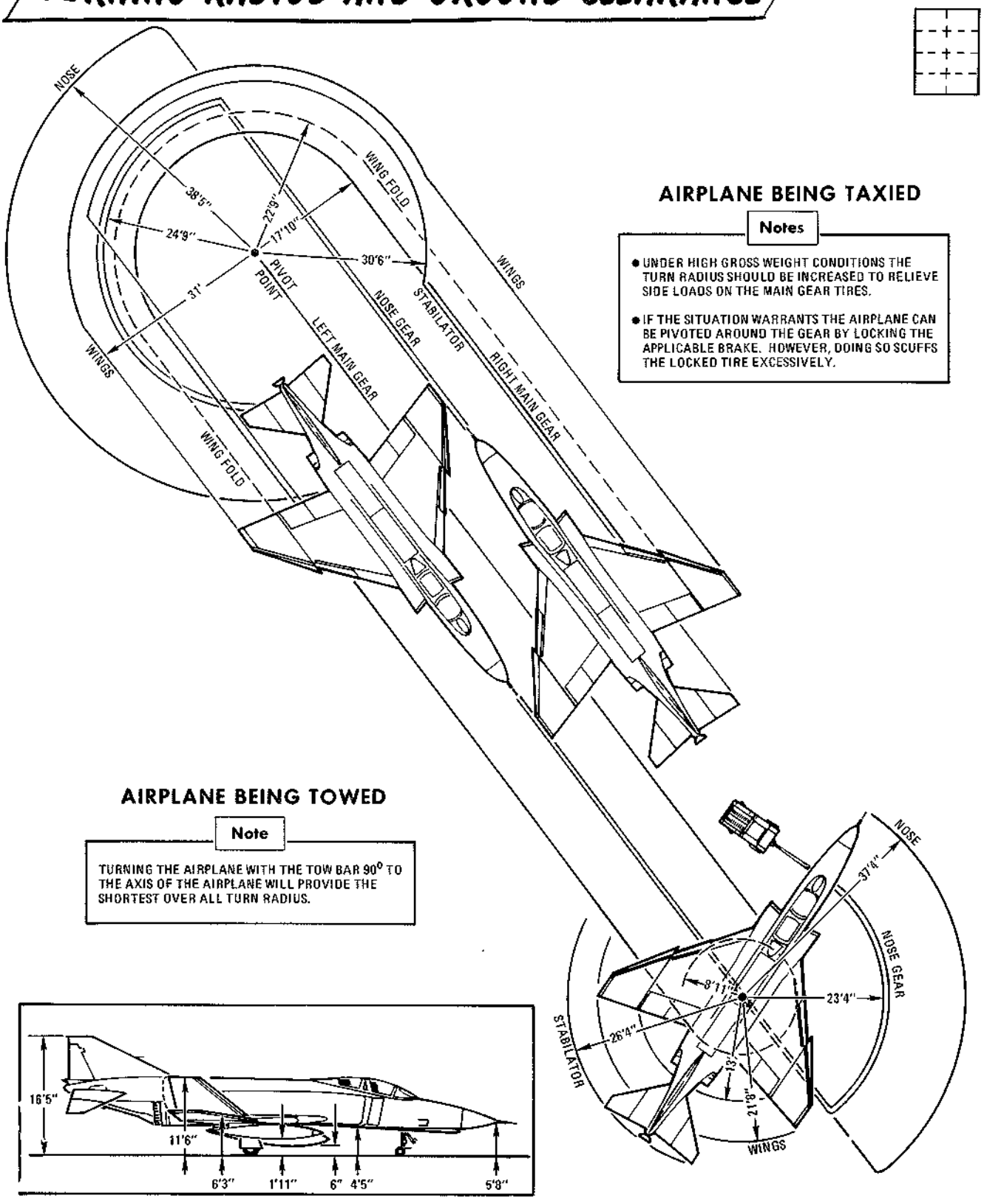
3. (P-WSO) Flight instruments – CHECK OPERATION
4. (P-WSO) Oxygen diluter lever – AS REQUIRED

BEFORE TAKEOFF

CAUTION

Exercise care in positioning the aircraft on the runway during formation operations. Clearance behind aircraft should be 150 feet at military thrust settings and 300 feet at maximum thrust settings. Try to stagger the airplane positions so that no aircraft is directly behind another. Ensure that the canopies are closed and locked. Refer to figure 2-3 for Danger Areas.

TURNING RADIUS AND GROUND CLEARANCE



AIRPLANE BEING TAXIED

Notes

- UNDER HIGH GROSS WEIGHT CONDITIONS THE TURN RADIUS SHOULD BE INCREASED TO RELIEVE SIDE LOADS ON THE MAIN GEAR TIRES.
- IF THE SITUATION WARRANTS THE AIRPLANE CAN BE PIVOTED AROUND THE GEAR BY LOCKING THE APPLICABLE BRAKE. HOWEVER, DOING SO SCUFFS THE LOCKED TIRE EXCESSIVELY.

AIRPLANE BEING TOWED

Note

TURNING THE AIRPLANE WITH THE TOW BAR 90° TO THE AXIS OF THE AIRPLANE WILL PROVIDE THE SHORTEST OVER ALL TURN RADIUS.

4E-1-(56)

Figure 2-4

1. Optical sight - CHECK
2. (P-WSO) Harnessing and leads - FASTENED
   Parachute risers, lap belt, leg restraint lines and all other harnessing and leads fastened.
3. Internal wing transfer switch - NORMAL
4. Stab aug switches - ENGAGE
5. Flight controls - UNRESTRICTED (WSO visually check control surfaces)
6. Slats flaps - CHECK OUT AND DOWN
   If flaps are raised after leaving the flight line, they must be visually checked out and down when they are again lowered.
7. Anti-ice switch - AS REQUIRED
8. Stabilator trim - CHECK 1 TO 3 UNITS NOSE DOWN
9. Fuel quantity - CHECK
10. (P-WSO) Canopies - CLOSE, CHECK WARNING LIGHT OUT AND STRIPES ALIGNED
    a. Operate engines at idle rpm.

CAUTION

Closing of either canopy with engine rpm above idle may result in the canopy not fully locking due to premature canopy seal inflation and/or back pressure caused by cockpit pressurization system.

b. Set air temperature control knob no higher than 2 o'clock and the defog-footheat lever in foot heat. An air temperature control knob setting higher than 2 o'clock may prevent the canopy from fully locking due to excessive pressure.
c. Close aft canopy. Ensure closing time does not exceed 9 seconds from lever actuation to completion of locking cycle. Check aft CANOPY UNLOCKED light out, forward CANOPY UNLOCKED light ON.
d. Close forward canopy. Ensure closing time does not exceed 9 seconds from lever actuation to completion of locking cycle. Check forward CANOPY UNLOCKED light out. WSO observe front canopy actuator sheer pin for integrity and actuating cylinder full up.

CAUTION

The center mirror on the forward canopy can be tilted sufficiently to prevent canopy closing; therefore, assure that the mirror will clear the windshield bow before closing canopy.

e. Check that alignment stripe on canopy lock push rod aligns with the alignment stripe on the bracket hanging from the left canopy sill. The canopy over-center locking mechanism does not actually lock the canopy until approximately the last ¼ inch of push-pull rod movement.

WARNING

If a canopy malfunction occurs during the closing cycle or in the event that either the front or aft CANOPY UNLOCKED light remains on after attempted closure, refer to Canopy Malfunction, section III.

CAUTION

To ensure canopy retention during flight, the canopy control handle must be retained in the closed (full forward detent) position.

11. Defog—footheat and temperature controls — AS REQUIRED
    When operating in high humidity conditions, a higher than normal temperature setting (3 o'clock or above may be required to prevent cockpit fogging.

WARNING

A cockpit temperature malfunction (cold) in high humidity conditions may cause sufficient fog to obscure forward visibility during takeoff roll. A defog-footheat setting forward of footheat may compound the forward visibility problem and require immediate action to dump the cabin pressure in order to maintain visual contact with the runway or leader.

12. (WSO) Command selector valve — AS BRIEFED
13. (P—WSO) Lower ejection handle safety guard — CLEAR
    Rotate the lower ejection handle safety guard to the down (horizontal) position.

WARNING

The lower ejection handle safety guard, when lowered too rapidly, can rebound to the safe position.

14. Warning lights/voice warning system — TEST.
    After TO 1F—4—1262, CANOPY—CANOPY ALTITUDE—ALTITUDE is heard in both headsets when the front cockpit warning lights test switch is placed to TEST (WARN TEST). After TO 1F—4—1262, TO 1F—4—1484, and TO 1F—4—1503, FIRE—FIRE, CANOPY—CANOPY, ALTITUDE—ALTITUDE is heard. Adjust voice warning volume as desired.

After runway line-up -

15. External transfer switch - AS DESIRED

WARNING

- If external tanks are installed, and the external transfer switch is positioned to OUTBD or CENTER, internal wing fuel will not transfer even though the internal wing transfer switch is positioned to NORMAL.
- Have any leak which cannot be positively identified as the dump mast investigated prior to takeoff.

16. Anti-skid - ON, LIGHT OUT
17. Compass heading - CHECK
    If a significant error exists on the HSI compass card resynch the compass by placing the compass controller mode switch to the SYNC position momentarily. If this doesn't resolve the problem or the heading returns to an incorrect heading when the switch is released, wait 20 seconds and repeat the procedure. If the heading remains incorrect, check the AN/AJB-7 heading by placing the reference system selector to STBY and note difference between PRIM and STBY headings.
18. Pitot heat - ON
    Pitot heat should not be used for more than 1 minute on the ground.
19. IFF - AS REQUIRED
    If the KIT-1A transponder is installed and keyed, the Mode 4 ON/OUT switch must be ON and the master switch in LOW or NORMAL to prevent illumination of the IFF and MASTER CAUTION lights during MODE 4 interrogations.
20. (P-WSO) Circuit breakers - CHECK
21. Warning lights - CHECK
22. Radar altimeter - OFF (after TO 1F-4-1262)
    After TO 1F-4-1262, turn radar altimeter OFF until above low altitude warning setting to prevent an ALTITUDE-ALTITUDE voice warning during taxi, takeoff or after takeoff-climb.

TAKEOFF

NORMAL TAKEOFF

The slats out-flaps down position is recommended for all takeoffs. After taking the runway and completing necessary pre-takeoff checks, engines can be run to 85% with brakes held and nose gear steering engaged to ensure nose gear alignment (figure 2-5). With both engines operating in excess of 85% and the brakes locked, there is a possibility of rotating the tires on the wheel rims or skidding the tires. Check for normal rpm response and approximate readings of 450°C EGT, 4000 pph fuel flow, ¼ nozzles, and 30-40 psi oil pressure. If readings are significantly different, run the affected engine(s) individually to MIL and compare with section V limits. After releasing brakes, advance both throttles rapidly to full military power and check rpm, exhaust temperatures and nozzle position. WSO check the ramps fully retracted. If an afterburner takeoff is desired, shift the throttles into the afterburner detent and advance full forward for max thrust. Maintain directional control with nose gear steering or rudder as required. The rudder becomes effective for steering at approximately 70 knots. Do not use wheel braking for directional control during takeoff roll except in an emergency. Nose gear steering should be disengaged when rudder steering becomes effective. If it becomes necessary to re-engage nose gear steering at the higher speeds, rudder pedals should be returned to neutral prior to engagement since rudder displacement necessary for rudder steering will generally be excessive for nose gear steering. Sufficient aft stick should be applied prior to nose wheel liftoff speed to attain the desired pitch attitude. As the nose rises, pitch attitude must be controlled to maintain a 10° to 12° (first pitch mark) nose high attitude for aircraft fly-off. Caution must be exercised to preclude over-rotation due to excessive aft stick rate or an extended takeoff roll due to late lift-off. The basic takeoff attitude should be held during acceleration and transition to a clean configuration. Trim change and control action during this period are normal. The AUX AIR DOORS, WHEELS, and MASTER CAUTION lights may illuminate momentarily as the landing gear and flaps are retracted.

WARNING

Nose gear steering (NGS) malfunctions can cause loss of directional control. If unscheduled steering responses are detected when using NGS before rudder control becomes effective, disengage NGS immediately and use brakes as required for directional control. Do not reengage NGS.

CAUTION

Rapid full aft movement of the stick between takeoff airspeed and 30 knots below takeoff airspeed may result in the stabilator hitting the runway with the possibility of stabilator actuator damage.

NO-FLAP TAKEOFF

No-flap takeoffs are not recommended. However, if it is determined that no-flap takeoffs must be performed to satisfy mission requirements, aircrews should be aware that takeoff roll and airspeed will be increased and the takeoff attitude will be slightly steeper. Stabilator effectiveness is considerably increased and extreme caution must be exercised to prevent overrotation which could result in the stabilator striking the runway.

WARNING

Due to increased stabilator authority with the flaps up, aircraft rotation can be initiated at lower than normal airspeeds and overrotation is a definite possibility. If it appears that overrotation is occurring, positive control movement (stick forward) must be taken to prevent the stabilator from contacting the runway and/or loss of aircraft control.

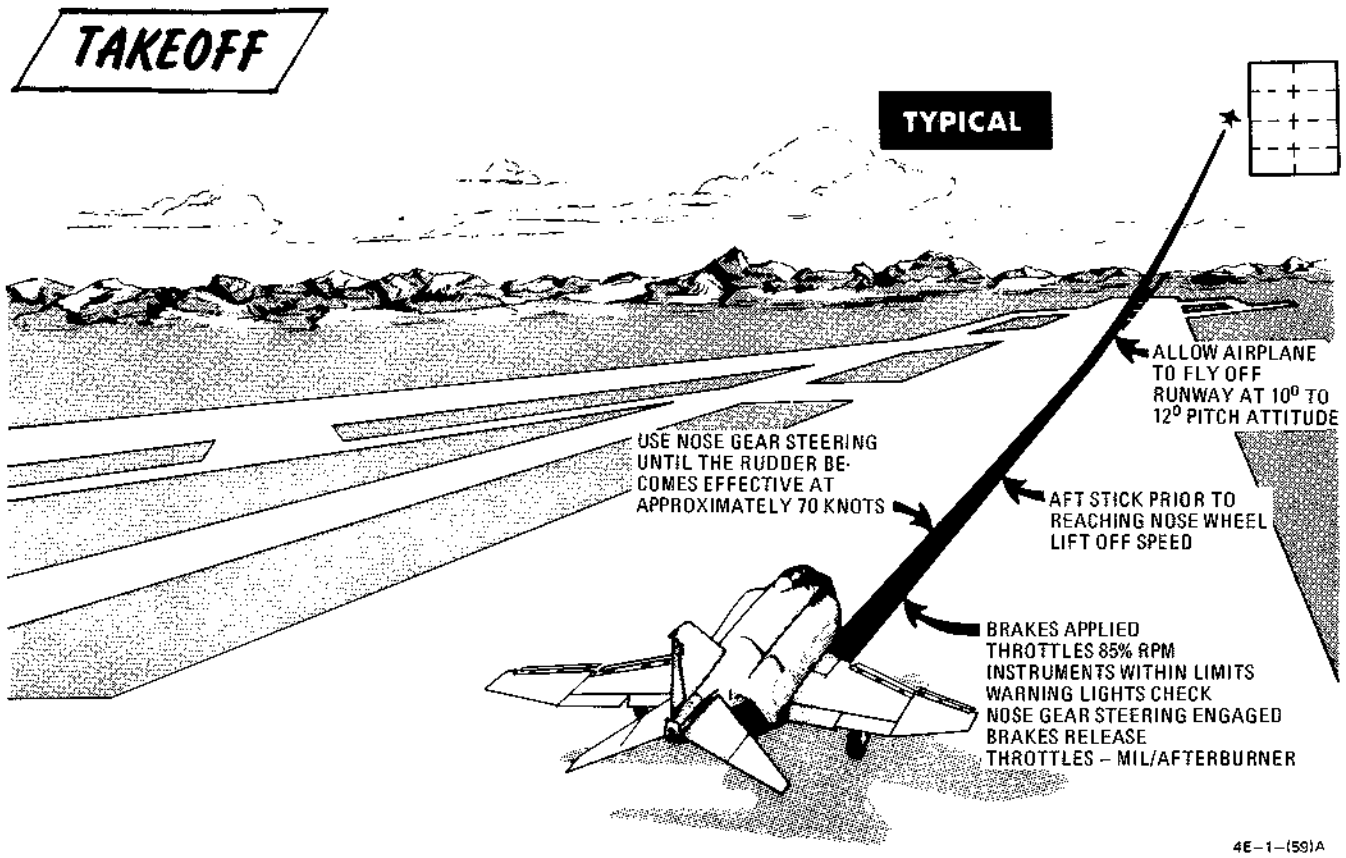


Figure 2-5

MINIMUM RUN/HEAVY GROSS WEIGHT TAKEOFF

A minimum run/heavy gross weight takeoff (aircraft over 55,500 pounds) is accomplished in the same manner as a normal takeoff with the following exceptions: It is recommended that all minimum run/heavy gross weight takeoffs be made with afterburner. During the takeoff run, full aft stick must be applied prior to reaching 80 knots. As the aircraft starts to rotate, the stick should be adjusted to maintain 10° to 12° pitch attitude for aircraft fly-off. The possibility of a main landing gear tire failure increases with an extended takeoff ground run under heavy gross weight conditions. Nose wheel liftoff speed and takeoff speed is increased during heavy gross weight conditions. In the event of an aborted takeoff, it must be remembered that stopping distance is greatly increased as abort speed increases.

CAUTION

With a combination of light gross weight and aft CG, the minimum run takeoff technique (i.e., full aft stick prior to reaching 80 knots) produces rapid pitch rates during nose rotation. This combination can exist when the radar package and nose gun (or equivalent ballast) are not installed.

CROSSWIND TAKEOFF

Under crosswind conditions, the aircraft tends to weather vane into the wind. The weather vaning tendency can be easily controlled with nose gear steering. As forward speed increases, weather vaning tendency decreases. At speeds above 70 knots rudder effectiveness will normally be sufficient to maintain directional control. After the nose is lifted to takeoff attitude, the aircraft will have a tendency to drift toward the downwind side of the runway. Therefore, when a long time period is expected between nose lift-off and aircraft fly-off, or when the crosswind effect is particularly severe, nose lift-off can be delayed accordingly. Under normal operational conditions this action should not be required. As the aircraft leaves the ground, it should be crabbed into the wind, wings level, to maintain runway alignment. Takeoff in gusty crosswind or severe wake turbulence conditions can result in an abrupt wing low attitude at or near lift-off. When these conditions are anticipated, use higher than computed takeoff speed to provide additional lateral control after lift-off.

AFTER TAKEOFF – CLIMB

When the aircraft is definitely airborne–

1. Gear – UP
   Check that the landing gear position indicators display the word UP, and that the landing gear

handle warning light is out.

CAUTION

- The landing gear and gear doors should be completely up and locked before the gear limit airspeed of 250 knots is reached, otherwise, excessive air loads may damage the landing gear mechanism and prevent subsequent operation.

- When actuating the landing gear, keep a forward pressure on the landing gear control handle to prevent inadvertent actuation of the emergency system.

2. Slats flaps – NORM (180 knots minimum)
   Check that slat flap indicators display IN and UP. Rudder jumps may occur during flap retraction with a lateral stick input. If an audible (noticeable in head phones) chattering associated with slat flap and utility hydraulic pressure indicator fluctuating in unison occurs during slats flaps retraction, maintain airspeed below 250 knots and cycle slats flaps. If slat chatter occurs during maneuvering at altitude, it may require opposite slats positioning from where chatter occurs. If chatter persists, extend slats flaps and land as soon as practical. If cycling (slats repositioning) eliminates chatter, continue mission and make an appropriate entry in AF Form 781.

CAUTION

Continued or prolonged operation with flap or slat chatter will damage actuator(s) and mechanisms.

NOTE

- During the climb, it may be necessary to place the antenna selector switch to the LWR position to maintain ground communication.

- When transmitting on UHF using the lower antenna, a change in engine operation could occur. This can be seen as a shift or fluctuation of EGT, RPM, FUEL FLOW, and NOZZLE position.

CLIMB

A simplified climb can be made by maintaining a 10° to 12° (first pitch mark) nose high attitude until reaching 350 knots and then vary pitch as necessary to maintain 350 knots until reaching cruise Mach/TAS. Vary pitch as necessary to maintain cruise Mach/TAS until reaching cruise altitude. A simplified Maximum thrust climb, at normal gross weights, can be made by maintaining a 10° to 12° nose high attitude until reaching 350 knots and then vary pitch as necessary to maintain 350 knots until reaching Mach 0.9. Vary the pitch attitude as necessary to maintain Mach 0.9 until reaching cruise altitude.

CRUISE

1. (P-WSO) Altimeters – SET, CHECK STBY, RESET, COMPARE
   The following maximum tolerances should be met at subsonic speeds:

ALT FT	DIFF FRONT & REAR		ALTM JUMP (STBY TO RESET)
	BOTH STBY	BOTH RESET	
10,000	150 FT	75 FT	100 FT
20,000	250 FT	75 FT	150 FT
30,000	350 FT	75 FT	200 FT

NOTE

- If the altimeter is not within tolerance in RESET, the mission may be continued in STBY. Altimeter accuracy will be degraded.

- The allowable difference between the front and rear altimeters in different modes is 200, 300 and 400 feet for altitudes of 10,000, 20,000 and 30,000 feet respectively.

2. Radar altimeter – AS REQUIRED
3. (P–WSO) Survival kit selector switch – AS DESIRED
4. (P–WSO) Ops check
   a. Oxygen quantity/pressure blinker
   b. Cockpit pressure indicator
   c. Fuel quantity/transfer switches
      If carrying external tanks, turn external fuel transfer switch to OFF after external tanks are empty, and keep internal wing transfer switch in NORMAL
   d. Standby compass
   e. Circuit breakers
5. Anti–ice switch – AS REQUIRED

WARNING

- When transfer of external fuel is selected, transfer of internal wing fuel is stopped automatically and cannot be regained until the external wing fuel transfer switch is turned OFF, even though the internal wing transfer switch is positioned to NORMAL. However internal wing fuel and external fuel will simultaneously transfer when the automatic fuel transfer circuit is energized. When the external fuel tanks are not carried, the external wing tank transfer switch is inoperative.

- The possibility exists that engine flameout may occur while flying above 35,000 feet in cirrus clouds. Such incidents have occurred, and are generally believed to have been caused by excessive ingestion of ice crystals. Under such conditions, ice buildup on the duct lips or other

CAUTION

If it is suspected that the brakes have been used excessively, and are in a heated condition, the aiplane should not be taxied into a crowded parking area. Peak temperatures occur in the wheel brake assembly 30 minutes after maximum braking. To prevent brake fire and possible tire explosion, the specified procedure for cooling brakes should be followed.

10. Mode 4 selector – HOLD (if another flight is anticipated in code period).
11. ECM/ALE/RWR/APX – OFF
12. Radar/CW power – OFF
13. (WSO) AVTR – OFF (some aircraft)
14. Stab aug switches – OFF
15. Internal wing dump switch – NORMAL

CAUTION

The internal wing dump switch must be placed to NORMAL position prior to engine shutdown. If the switch is left in DUMP, fuel spillage will occur during refueling with battery power.

16. VOR/ILS control panel – OFF
17. Engine anti-ice switch – NORMAL
18. Radar altimeter – OFF
19. Stabilator trim – SET 1 TO 3 UNITS NOSE DOWN
20. Reference system selector – STBY
21. Rain removal switch – OFF
22. Pitot heat switch – OFF
23. IFF – OFF
24. Temperature control knob – FULL HOT
    Place the temperature control knob to full HOT to evaporate any water that may have collected in the air conditioning system during descent.
25. Defog–footheat control handle – DEFOG
26. (P–WSO) Tacan – OFF
27. Formation lights – OFF
28. Sight shutter – CLOSED

ENGINE SHUTDOWN

1. Wheels - CHOCKED
2. UHF radio - OFF
3. (P-WSO) Ejection seat - RAISE
   The seat should be elevated to facilitate cockpit cleaning. If personnel lowering devices are installed, lean forward while raising the seat and avoid pressure on the seat back pad so it will not impinge on the bottom of the parachute container.
4. Defog-footheat control handle - FULL AFT
5. Temperature control knob - 12 O'CLOCK POSITION
6. Air refuel switch - AS REQUIRED
   Extend air refueling receptacle if air refueling was accomplished during mission.
7. (WSO) Inertial navigation power control knob — OFF (or align if required — then OFF) (without DMAS or NWDS)
8. (WSO) Navigation Computer — OFF (without DMAS or NWDS)
9. (WSO) Data transfer module—STORE DATA (with DMAS)
10. (WSO) Navigation computer set control INS knob — SYS OFF (or align if required — then SYS OFF) (with DMAS)
11. (WSO) Memory snapshot — PERFORM (with NWDS)
    a. Enter aircraft final parking coordinates into a D point on the destination table.
    b. Command a FLY—TO the D point created above.
    c. Select the Maintenance Menu—SHFT—PMD, L1, F2
    d. Command RER calculation by selecting the TAKE SNAPSHOT option on the Maintenance Menu (L3) once the aircraft has reached its final parking spot.

NOTE

In order for the system to calculate an RER, a GC alignment must have been accomplished prior to takeoff, groundspeed must be less than 50 knots at the time of the snapshot, and navigation time must be greater than 30 minutes.

12. (WSO) Stored heading alignment — COMPLETE (if required (with NWDS)
    For gyrocompass and stored heading alignment procedures, refer to TO 1F—4E—1—1—3.
13. (WSO) NWDS power switch — NWDS, THEN OFF
    Pause with the NWDS power switch in NWDS until the INS OUT light comes on (approximately 5 seconds) then place the NWDS power switch to OFF.
14. (WSO) DTC/DTM — REMOVE (if required) (some aircraft)
15. AVTR tape — REMOVE
16. (WSO) Target designator — OFF (some aircraft)
17. Right throttle — OFF
    On aircraft thru 69—7578, the right generator out light illuminates when the generator drops off the line. On aircraft 69—7579 and up, the BUS TIE OPEN light illuminates prior to the right generator out light and then goes out as the right generator out light illuminates.

CAUTION

Excessive rapid movement of the control stick with one engine operating may rupture the inoperative power control system reservoir.

18. Spoiler actuator — CHECK
    With the left engine operating and PC-2 pressure zero, slowly deflect the control stick approximately 1 inch to the right. Have ground crew or rear seat occupant verify that the spoiler does not fully deflect and that it returns to the flush position when the stick is returned to neutral. Any discrepancy should be entered in AF Form 781.
19. Left throttle — OFF

WARNING

When generator drops off the line the auxiliary air doors slam closed violently.

20. Engine master switches — OFF
21. APU reject switch — NORMAL (some aircraft)

BEFORE LEAVING COCKPIT

1. (P-WSO) All switches and controls - OFF
2. (P-WSO) Face curtain safety pin - INSTALLED

WARNING

Ensure that all personal equipment leads and straps are free of cockpit controls and ejection seat handles.

3. (P-WSO) Oxygen diluter lever - 100%

SPECIAL PROCEDURES

SOLO FLIGHT INSPECTION (REAR COCKPIT)

1. Command selector valve handle – VERTICAL (closed)
2. Bulkhead mounted canopy initiator safety pin – REMOVED (all other pins installed)
   With the initiator safety pin installed, the front canopy cannot be jettisoned by means of the canopy jettison lanyard.

CAUTION

Exercise caution regarding hand movements in the vicinity of the bulkhead mounted canopy initiator linkages. Also, do not stow flight equipment or personal items in this area. Failure to comply could result in inadvertent jettisoning of the canopy.

3. Lap belt, leg restraints, and harness assembly – SECURED
4. Communication–navigation control panel – SET
   a. COMM–AUX pushbutton – TR + G – ADF
   b. Communication channel control knob/mode selector switch – GUARD
   c. Navigation function selector knob – T/R
   d. Navigation channel control knob – AS REQUIRED
5. Emergency slat flap handle – FORWARD
6. Function selector switch – HOT MIC
7. Amplifier selector knob – NORM
8. Oxygen supply lever – OFF
9. Emergency gear handle – IN AND SECURE
10. Emergency brake handle – IN AND SECURE
11. Radar scope retaining pins – INSTALLED
12. Radar power selector knob – OFF
13. Battery bypass switch – OFF
14. Circuit breakers – IN
15. Electrical test receptacle plug 3P325 – ENSURE PLUG SEATED FLUSH, KNURLED LOCK RING SECURE, CAP TIGHT.
    It is possible to trip both generators off the line if the electrical test receptacle plug 3P325 under the right canopy sill is loose. The plug uses a knurled (twist clockwise to lock) lock ring and should not be confused with the chain equipped threaded cap.
16. Cockpit light switches – OFF
17. All loose items – SECURE
18. All other equipment – AS REQUIRED
19. Instrument ground power switch – ACTUATE (cannot be performed when battery start is made)
    Actuate the instrument ground power switch to energize the instrument 115/200 volt ac bus and the instrument 28 volt ac bus.
20. Inertial navigation set – ALIGNED (without DMAS)
    Align the INS as outlined in After Electrical Power (Rear Cockpit).
21. DMAS – ALIGNED (with DMAS)
22. NWDS – ON, LOADED, INU ALIGNED (with NWDS)
    Refer to TO 1F–4E–34–1–1–3 for NWDS turn on procedures.
23. Canopy – CLOSED

CARTRIDGE START

This procedure is based upon external power not being available. During routine (other than scramble/exercise) cartridge starts, it is advisable to use external electrical power, if available, as this will allow use of the CNI and all engine instruments during the start. If external power is used, normal generator switching should be used. To avoid possible irritation caused by cartridge exhaust smoke/gases, it may be advisable to close canopies and select 100% oxygen during start cycle.

WARNING

Never attempt to load or unload a cartridge in either starter with the engine master switches on, ground refueling switch on, or external electrical power applied. If a malfunction in safety circuits occurs, serious injury could result.

1. Engine master switches – ON
2. Right generator switch – GEN ON
3. Ignition button – PRESS AND HOLD WHILE ADVANCING THROTTLE
   Press the ignition button and simultaneously move the throttle halfway up the quadrant, and then return the throttle to IDLE. The rear crewmember will check for appropriate throttle movement during start. If throttles are not engaged, reconnect after engine start.

4. Engine start switch – R (right)
   The start switch should be returned to the center position once cartridge ignition is started. Releasing the spring-loaded switch may allow it to bounce across the neutral position and fire the left cartridge. Once cartridge ignition has been initiated, the engine will continue to accelerate until the cartridge propellant is consumed. The start may be discontinued by moving the throttle to OFF or, with the other engine master switch ON, moving the engine master switch to OFF.

WARNING

- If there is absolutely no indication of an engine rpm rise and no smoke is visible at the starter exhaust port, a misfire has occurred. It will not be possible to start the engine until the starter is reloaded. Refer to Cartridge Mode Starting Malfunctions, section III.
- If smoke is visible at the starter exhaust port but the engine does not reach idle rpm, a hangfire or hangstart has occurred, refer to Cartridge Mode Starting Malfunctions, section III.

15. To load additional MWODs, set channel selector knob to 20 and repeat steps 6 through 14 above. Six most recently entered WODs will be stored in the radio
16. Channel selector knob – 01
17. Set frequency selector knobs to current day–of–month
18. Tone button – PRESS/RELEASE (single beep)
19. Preset/manual switch – PRESET
20. Channel selector knob – 20
21. Frequency selector knob – 220.000
22. Set pushbuttons – PRESS/RELEASE (single beep) Radio ready to receive TOD and operate in active mode

SINGLE ENGINE TAXI

When required left engine may be shut down first.

1. Right generator switch – OFF
2. BUS TIE OPEN light – OUT
3. Utility hydraulic pressure indicators – WITHIN LIMITS
4. Right engine throttle – OFF (prior to entering hot pad area if hot refueling)

HOT REFUELING

Before refueling –

1. Single–engine taxi procedures – COMPLETE
2. (P–WSO) Leg restraints, harness and personnel equipment leads (except oxygen and communications) – DISCONNECT IF CANOPY FULLY OPEN AND WILL REMAIN OPEN
3. Internal wing transfer switch – NORMAL
4. External transfer switch – OFF
5. Air refuel switch – EXTEND
6. Stop aircraft as directed by ground crew for tire/brake inspection and pinning of tanks and ordnance.

WARNING

- Do not turn generator switches off during this time as any interruption in electrical power will cause the auxiliary air doors to close violently with possible injury to ground crew.
- Do not enter hot pad area with hung ordnance aboard or if a known hot brake condition exists. If notified of hot brakes, taxi clear of the refueling area.

7. After entering hot pad area, establish three–way voice contact (intercom with pilot, refueling supervisor and servicing crew member).

WARNING

Any time three–way voice contact cannot be maintained, discontinue refueling immediately.

8. Refuel selection switch – AS DESIRED
   Fuel configuration should be determined by mission requirements/local directives.

During refueling –

1. Remain alert to all visual and voice signals from the refueling supervisor.
2. Monitor ground control frequency.

WARNING

- Radio transmissions are prohibited in the hot pad area except in an emergency.
- If fuel starts venting from the aircraft, place the refuel selection switch to INT ONLY and discontinue refueling immediately.
- In the event of fire or fuel leak on the aircraft or ramp area under the aircraft, shut down the left engine and evacuate aircraft.
- In the event of fire or fuel leak in the refueling hydrant control area (other than immediate vicinity of aircraft), discontinue refueling and taxi out of area if directed by ground crew.

After refueling –

1. Air refuel switch – RETRACT
2. Refuel selection switch – INT ONLY

DMAS PRE–SCRAMBLE ALIGNMENT

The following may be performed if the aircraft is to be placed on alert status and not moved following engine shutdown. DMAS rapid reaction alignment time is approximately 3 minutes if the following full gyrocompass alignment is accomplished.

1. NCSC mode knob – AS REQUIRED
2. NCSC INS knob – SYS OFF FOR 2 MINUTES
3. NCSC INS knob – STBY, THEN ALIGN
   a. Align light – ON

CAUTION

Do not move aircraft with the ALIGN light ON nor with the INS knob in ALIGN.

4. DTM – INSERT, PERFORM DATA TRANSFER/STORE PROCEDURE (if DTM available)

5. Power on list – PERFORM
6. Nav light – OBSERVE FLASHING
7. NCSC INS knob – SYS OFF

NWDS PRE-SCRAMBLE ALIGNMENT

The following may be performed if the aircraft is to be placed on alert status and not moved following engine shutdown. NWDS Stored Heading alignment time is approximately 90 seconds if the following full gyrocompass alignment is accomplished.

1. DTC (if required) – INSERTED IN DTU (handle down)
2. NWDS power switch – INU/NWDS
   Placing the power switch to INU/NWDS applies power to both the INU and the NWDS LRU's. If the OFP is loaded in the NWDS, the CDU will automatically display the Initialization Display and allow verification/entry of aircraft data. If the OFP is not loaded in the ACU, a DTC containing the OFP must be installed in the DTU with the DTC handle latched down. The CDU will display the Select Configuration display to allow loading of the proper aircraft software configuration when commanded by the operator. The INU is powered on and enters a standby mode for approximately 4 seconds until a valid alignment command is received from the ACU.
3. CDU initialization display – DATA ENTERED/MODIFIED (as required)
   The initial Latitude, Longitude, and Elevation (MSL) must be entered.

NOTE

Present position data for a GC alignment must be entered within 2 minutes of alignment; otherwise, the alignment process will start over from the time of the present position entry.

4. Configuration display – VERIFY/ENTERED (as required)
5. DTC mission data – LOAD (IF REQUIRED)
   a. Initialization display – SELECTED
   b. Mission data – LOAD
6. Alignment mode – GC

NOTE

For Stored Heading Alignment (SH), a GC alignment must be completed and the NWDS shut down prior to going to NAV. The aircraft must not be moved between shutdown and completion of SH alignment at SCRAMBLE.

7. NWDS power switch – OFF
   Place the NWDS power switch to OFF when the INU alignment displays 0.8 NAV READY.

SCRAMBLE

The following scramble procedures assume that the following actions have been completed prior to the aircraft being placed on an alert status (subject to scramble type activities):

a. Complete preflight inspection to include a power-on cockpit inspection, engine operational check, and operational check of speed brakes, flaps, flight controls and stab aug in accordance with normal BEFORE TAXIING (FRONT COCKPIT) checks.
b. INS aligned and placed in heading memory. (without DMAS or NWDS)
c. DMAS pre-scramble alignment completed. (with DMAS)
d. NWDS pre-scramble CG alignment completed. (with NWDS)
e. Aircraft is cocked for scramble per local policy and instructions.

If the above actions are not completed prior to scramble, normal procedure should be used.

BEFORE TAXIING (FRONT COCKPIT)

1. Communication and navigation equipment – ON AND CHECK
2. Emergency attitude indicator – SET
3. Altimeter and SPC – SET AND CHECK
4. Takeoff trim – CHECK
5. Slats flaps – OUT AND DOWN (groundcrew visually check)
6. Clearance to taxi from WSO.
7. Reference system selector – PRIM
8. Seat pins – CHECK REMOVED AND STOWED
9. Personal equipment – CHECK
10. Wheel chocks and ground interphone cord – REMOVED

BEFORE TAXIING (REAR COCKPIT)

1. Communication and navigation equipment – ON AND CHECK
2. APX-80 mode switch – PASSIVE/OFF
3. Pressure altimeter – SET AND CHECK
4. Radar power – STBY
5. Radar overtemp light – OFF, MONITOR
6. Navigation computer function selector knob – STBY (without DMAS or NWDS)
7. Heading memory alignment – COMPLETE (without DMAS or NWDS)
   If the inertial navigation set has not been previously aligned for heading memory, attitude reference can be obtained by performing a coarse alignment (ALIGN – wait 40 seconds – NAV).

WARNING

When coarse alignment is utilized, the pilot must be prepared to switch to the standby attitude reference system at the first indication of primary system failure or malfunction.

8. Rapid reaction alignment – COMPLETE (With DMAS)
   a. NCSC mode knob – AS REQUIRED

NOTE

If a subsequent LORAN lock is not obtained, information is not available to the IMU to complete a full gyrocompass alignment (i.e., NCSC LRN status light, DDI NO SIG and NEW STA light remain on throughout flight). IMU navigational accuracy is degraded.

   b. NCSC INS knob – NAV
   c. Align light – ON

CAUTION

Do not permit aircraft to be moved while ALIGN light is on. Degraded navigation results.

   d. DTM – INSERT, PERFORM DATA TRANSFER/STORE PROCEDURE (if DTM available)
   e. Power on list – PERFORM
   f. After approximately 3 minutes, ALIGN light OFF, NAV light ON
      Aircraft may be taxied after ALIGN light goes off.
9. Stored heading/BATH alignment – COMPLETE (with NWDS)
   a. NWDS power switch – NWDS
   b. BATH alignment heading – ENTERED (if required)
      A BATH alignment provides a rapid reaction alignment capability if the aircraft was not set up to perform a stored heading alignment.
   c. NWDS power switch – INU/NWDS
   d. INU – NAVIGATE
      When the INU has completed a satisfactory alignment the WSO should command a FLY–TO or press the A key to place the INU into NAV mode. A degraded alignment may be accepted any time after a reverse hilighted NAV READY appears (approx 10 seconds time in align). A normal NAV READY will appear after approximately 90 seconds and indicates full system capability (0.8 NM/HR CEP).
10. Navigation computer function selector knob – AS DESIRED (without NWDS)
11. Seat pins – CHECK REMOVED AND STOWED
12. Personal equipment – CHECK
13. Notify pilot – CLEAR TO TAXI

BEFORE TAKEOFF

1. Flight instruments – CHECK AND SET
2. Stab aug switches – ENGAGE
3. Flight controls – UNRESTRICTED (WSO visually check control surfaces)
4. (P–WSO) Canopies – CLOSE AND CHECKED
5. (WSO) Command selector valve – AS BRIEFED
6. (P–WSO) Lower ejection handle guards – CLEAR
7. Fuel panel – SET AND CHECKED
   a. Internal wing transfer switch – NORMAL
   b. External transfer switch – AS REQUIRED
8. Slats flaps – CHECK OUT AND DOWN
9. Anti–skid – ON; LIGHT OFF
10. Warning lights – CHECKED
11. Anti–ice – AS REQUIRED
12. Pitot heat – ON
13. IFF – AS REQUIRED
14. (P–WSO) Circuit breakers – CHECK

OPERATIONS ON BOMB–DAMAGED RUNWAYS

TAXI

To prevent possible tire or structural damage, taxi speeds on bomb–damaged surfaces should be limited to approximately five knots. Use of braking while crossing unrepaired spalls is not recommended. Unrepaired spalls are shallow craters that are up to approximately two feet in diameter and approximately one and one–half inches deep.

TAKEOFFS

During operations on damaged runways containing unrepaired spalls, minimize the weight on the landing gear to prevent excessive loads and possible structural failure of the gear struts. A minimum run takeoff with afterburner and flaps down should be made. During the takeoff run, full aft stick must be applied prior to reaching 80 knots. As the aircraft starts to rotate, the stick should be adjusted to maintain 10 to 12° pitch attitude for aircraft fly–off.

LANDINGS

On landing, maintain maximum practical aft stick and do not retract flaps until below 30 knots. No–flap landings are not recommended.

NOTE

Because of the sharp impact loads on the landing gear, the exterior of the struts and tires should be visually inspected after each operation over damaged runways.

SECTION III

EMERGENCY PROCEDURES

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This section contains procedures to be followed to correct an emergency condition. These procedures will insure maximum safety for the crew and/or aircraft until a safe landing or other appropriate action is accomplished. The procedures are arranged in the most desirable sequence for the majority of cases; therefore, the steps should be performed in the listed sequence unless the pilot can determine a good cause for deviation. Multiple emergencies, adverse weather, and other peculiar conditions may require modification of these procedures. The critical items **(BOLD FACE LETTERS)** contained in the various emergency procedures cover the most adverse conditions. Aircrew members will be able to accomplish bold face procedures without reference to the checklist. The nature and severity of the encountered emergency will dictate the necessity for complying with the critical items in their entirety. It is essential, therefore, that aircrews determine the correct course of action by use of common sense and sound judgement. As soon as possible, the pilot should notify the WSO, flight, or flight leader, and tower of any existing emergency and of the intended action.

The terms "Land as soon as possible" and "Land as soon as practical" are used in this section. These terms are defined as follows:

Land as soon as possible – An emergency will be declared. A landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, ambient lighting, aircraft gross weight, and command guidance.

Land as soon as practical – Emergency conditions are less urgent, and although the mission is to be terminated, the degree of the emergency is such that an immediate landing at the nearest adequate airfield may not be necessary.

The following basic rules apply to all aircraft emergencies and should be thoroughly understood by all aircrew:

1. Maintain aircraft control.
2. Analyze the situation and take proper action.
3. Land as soon as practical.

NOTE

- For all landings, make a fully configured (slats flaps OUT AND DOWN, gear down) on-speed approach unless directed otherwise.
- Should the bailout bottle be used as a back up oxygen supply, it may not provide adequate oxygen when used at low altitude.

WARNING

The canopies should be retained during all emergencies, except ditching, that could result in a crash or fire such as crash landings, aborted takeoffs, and arresting gear engagements. The protection the canopies afford the crew during these emergencies far outweigh the isolated risk of entrapment due to a canopy malfunction or overturn. During the aircraft abandonment phase, normal canopy opening procedures should be considered first to preclude the possibility of a static seat ejection.

GROUND OPERATION EMERGENCIES

CANOPY MALFUNCTION

In the event of unusual noise or other abnormal occurrence when the canopy is being closed or opened:

1. Notify egress personnel
2. (WSO) Command selector valve – VERTICAL
3. Do not actuate canopy lever
4. Remain strapped in until egress personnel check/safe the seat/canopy

WARNING

Do not taxi the aircraft with a known canopy malfunction with the canopy open. The canopy may separate from the aircraft causing damage to the aircraft and/or injury to the aircrew.

COCKPIT OVERPRESSURIZATION

1. Emergency vent knob – PULL

WARNING

Do not attempt to open the canopy by the normal method if the cockpit is overpressurized since this may cause the canopy to lift and separate from the aircraft and fall on the banana links resulting in an inadvertent ejection.

If vent knob does not relieve pressure –

2. Cockpit heat and vent circuit breaker – PULL (C8, No. 3 panel)

CARTRIDGE MODE STARTING MALFUNCTIONS

Failure to start while in the cartridge mode may be caused by a malfunction in the cartridge, the starter, or the engine. Malfunctions are classified as misfires, hangfires, and hangstarts. In addition, the starter can fail catastrophically due to overpressurization. The pilot and ground crew can recognize a misfire; however, they may not be able to distinguish between a hangfire and hangstart.

MISFIRE

A misfire is defined as a failure of the cartridge ignitor squib to fire. This may be caused by a failure of the electrical ignition system, failure of the cartridge squib, or no contact between the cartridge ground clips and starter. A misfire may be detected by the absence of engine rotation and absence of smoke at starter exhaust door. When a misfire occurs, follow the Cartridge Start Malfunction procedure. After removal of the misfired cartridge, inspect cartridge ground clips to ensure they have been bent up sufficiently to make contact. Ensure that safety clip has been removed. If no obvious correctable fault can be found with misfired cartridge, another cartridge start with a new cartridge may be attemped.

HANGFIRE/HANGSTART

A hangfire/hangstart is a condition where the engine fails to accelerate in a normal manner after initiation of cartridge start. A hangfire is a cartridge malfunction where the main propellant grain does not burn or only partially ignites. In either case, the ignitor squib fires, as evidenced by a small amount of smoke at starter exhaust and engine rotation to a low rpm. If the main propellant grain partially ignites, it may smolder until enough pressure has built up in the starter breech for complete ignition to occur. The smoldering may last as long as 2½ minutes. Hangfire is usually associated with extremely low cartridge soak temperature (−55°C). A hangstart is a start in cartridge mode in which engine rotation is produced but the engine does not accelerate to idle rpm.

Since the symptoms of a hangfire and a hangstart are similar and difficult to distinguish from each other, the following common procedure is established. If rpm hangs up below idle, complete the first two steps of Cartridge Start Malfunction procedure by retarding throttles to off and releasing ignition button. Be alert for possible engine rotational acceleration and re–initiate starting procedures as applicable, once sustained rotation is assured. If rotation ceases and there is no evidence of burning, complete Cartridge Start Malfunction procedure. To preclude a catastrophic failure due to a malfunctioning starter, do not attempt a second cartridge start until a successful pneumatic start has been accomplished. The malfunctioned start must be entered on Form 781 and both a successful pneumatic start and subsequent cartridge start are required to clear the 781 entry. If pneumatic start or second cartridge is unsuccessful, the starter must be removed and inspected. The second cartridge start requirement is not cause for grounding the aircraft and may be accomplished at a later time.

CARTRIDGE START MALFUNCTION PROCEDURE

1. Throttles – OFF
2. Engine master switches – OFF
3. Wait 5 minutes

WARNING

- Do not attempt to remove a cartridge until 5 minutes after all evidence of burning has ceased.
- Do not attempt to perform any work in auxiliary air door area when utility hydraulic system is pressurized unless auxiliary air door lock is installed, since any interruption of electrical power will cause the auxiliary air doors to close forcefully and could cause injury.

ENGINE FIRE OR OVERHEAT DURING GROUND OPERATION

This procedure should be completed if a FIRE/OVERHEAT light comes on or if other indications of an engine or aft section fire exists. During start, if notified by a qualified ground crewman that a tailpipe fire exists, continue the start and carefully monitor EGT and FIRE/OVERHEAT lights. If the ground crewman does not specify a tailpipe fire, if there is any suspicion that the fire is not confined to the tailpipes, if the EGT approaches the limit, or if a FIRE/OVERHEAT light comes on, complete this procedure.

1. **THROTTLES – OFF**
2. Engine master switches – OFF

WHEEL BRAKE FAILURE

Wheel brake failure may be caused by mechanical malfunction, utility hydraulic system failure, or a malfunction of the anti–skid system. Wheel brake failure during normal anti–skid cycling is difficult to recognize and, at any time, the cause of wheel brake failure is difficult to diagnose rapidly. Therefore, the following procedure ensures that, regardless of cause, actions are taken sequentially to provide for the various contingencies.

1. Hook – DOWN
2. Brakes – RELEASE
3. Emergency quick release lever – HOLD PRESSED
4. Brakes – APPLY

If normal braking is available without anti-skid, it is possible to lock the wheels which may cause a blown tire. The brakes may be very sensitive and, above normal braking speed, very light pedal pressure and small pedal deflection may lock a wheel. Runway condition and aircraft speed will dictate the amount of braking which can be applied. Plan to use all the available runway.

If braking returns –

5. Anti-skid switch – OFF
6. Emergency quick release lever – RELEASE
7. Hook – UP (if not needed)

If still no brakes –

5. Brakes – RELEASE

NOTE

Brakes must be released to allow emergency hydraulic fluid to enter the brake system. If not fully released, a shuttle valve prevents emergency brake fluid from entering the brake system.

6. Emergency brake handle – PULL
   If the emergency brake handle in one cockpit is not effective, pull the emergency brake handle in the other cockpit.
7. Brakes – APPLY
   Pedal pressure is the same as the normal system. Without anti-skid, it is possible to lock the wheels and cause a blown tire. The brakes may be very sensitive and, above normal braking speed, very light pedal pressure and small pedal deflection may lock a wheel. When practical, delay braking until slowed to normal braking speed. Slowly apply the brakes to the desired amount and hold until stopped. Plan on using all the available runway. Application and release of the brakes dumps some fluid; therefore, use steady brake pedal pressure. Do not taxi.

RUNWAY DEPARTURE

During taxi, takeoff, or landing, if departure from the load bearing surface is imminent, especially a high speed, rapid decisions must be made to minimize the risk to the crew and aircraft damage. Consideration of departure rate, angle, skid, terrain, ground condition, obstructions and ejection capability is necessary.

A go-around may or may not be possible. The ability to go-around depends on surface conditions, obstructions, distance required to accelerate to flying speed, and aircraft condition. Once airborne, consideration must be given to possible engine foreign object damage and airframe damage.

If a go-around is not attempted, consider shutting engines down to eliminate fire sources such as hot engine, pressurized hydraulics, and full power electronics. The decision to eject versus remaining with the aircraft must be tempered by the situation such as obstructions, speed, skid, crew boarding weight and landing gear integrity. In severe cases, the nose gear, or portion of it, may fail and enter the front cockpit floor resulting in possible inadvertent ejection and/or damage to the front cockpit ejection seat. A zero altitude ejection, even at high speed, may not be successful if conditions are severe. If the decision is made to eject, both crewmembers should pull their ejection handle.

EMERGENCY ENTRANCE AND EXIT

See figure 3-1.

EMERGENCY EVACUATION

WARNING

Crew members must coordinate the type escape to be used before initiating emergency evacuation or ejection.

1. **LOWER GUARD – UP**
2. **SHOULDER HARNESS – RELEASE**
3. **INSIDE HANDLE – ROTATE AFT**(completely disengage and discard)
   Survival kit release handle
   If the survival kit retaining straps fail to release or the drop line is attached to the left retaining strap, press the quick disconnect(s) in the survival kit harness attachment fittings.
4. **OUTSIDE HANDLE – LOCK UP**
   Emergency harness release handle. Keep your feet forward and legs relaxed until outside handle is locked up to ensure proper release of leg restraint lines.
5. Canopy – OPEN
   a. Normal
   b. Manual unlock handle
      With the normal canopy select lever in CLOSED and an operational normal system, it is impossible to unlock the canopy with the manual unlock handle.
   c. Emergency canopy jettison handle

WARNING

- If there is any indication of fire inside or outside the cockpit, ensure both crewmembers are ready to egress before opening either canopy.
- To prevent injury to rear crewmember, front crewmember must jettison his canopy first.

   d. Break canopy with canopy knife

WARNING

Knife cutting edge must face crewmember to prevent possible injury.

spin direction. The turn needle will always be pegged in the spin direction. AOA is not a primary indicator. Maintain full forward stick until the aircraft unloads. If under sustained zero or negative G with the airspeed increasing above 200 knots, the aircraft is no longer in a spin but may be in a rolling spiral preparatory to normal dive recovery. If full forward stick is maintained after flying speed is attained, inadvertent control inputs can produce yawing and rolling which may be interpreted as still being out–of–control. Use the following procedure only if the aircraft has not recovered using the Out–Of–Control Recovery procedure.

WARNING

Under most conditions, about 15,000 feet is required for spin recovery. If there is insufficient altitude for recovery, eject.

1. **STICK – MAINTAIN FULL FORWARD**
2. **AILERONS – FULL WITH SPIN/TURN NEEDLE**
3. **AIRCRAFT UNLOADED – AILERONS NEUTRAL**
4. If out of control at or below 10,000 feet AGL – EJECT

INVERTED SPINS

The aircraft is highly resistant to an inverted spin. Recovery from inverted spins can be accomplished rapidly with neutral flight controls. The Out—of—Control Recovery procedure will recover the aircraft from an inverted spin. However, if the pilot misidentifies inverted flight for an inverted spin and applies and holds full forward stick, a steady state inverted stall then becomes possible. A 3 to 8 units AOA recovery should be flown until sufficient speed for a dive recovery is obtained.

ENGINE FAILURE/MALFUNCTION DURING FLIGHT

If a malfunction is not immediately evidenced by explosion, engine vibration, or engine seizure, press and hold the ignition button in an attempt to restart the engine before excessive rpm is lost. A normal relight and acceleration should not be expected outside the airstart envelope, shown in figure 3–2. If engine failure occurs during air refueling, immediately disengage from the tanker and place the air refuel switch to RETRACT. On aircraft after TO 1F–4–903, the APU will provide back–up PC–1 hydraulic pressure for longitudinal control with the left engine inoperative.

CAUTION

To reduce the possibility of engine seizure, do not delay an airstart attempt.

SINGLE ENGINE FAILURE

With one engine inoperative, slight to moderate rudder deflection is required to prevent yaw toward the failed engine if the recommended AOA of 17 units is not exceeded. Sideslip should be kept as small as possible. Banking 5° into the good engine reduces the rudder force required to maintain zero sideslip. No one system is entirely dependent on a specific engine, thus loss of one engine will not result in the loss of a complete system. Monitor the utility hydraulic system (especially during turns) as the handling qualities are severely degraded with its failure.

Aircraft service ceiling for single–engine operation (military thrust or afterburner) is a function of aircraft configuration and gross weight. Optimum altitude and airspeed for single–engine flight can be approximated by accelerating or decelerating to 300 knots or 0.6 Mach, whichever is less. Climb or descend at military thrust to the optimum single–engine cruise altitude. Refer to Cruise Summary, One Engine Operating, figure A4–3.

During single–engine operation, use care to avoid rapid airspeed bleed–off and/or excessive sink rates. Limited thrust available makes airspeed response to power much slower than normal two engine operation. Afterburner may be required for climbs and turns.

1. Airspeed – 300 KNOTS/0.6 MACH MINIMUM
   Below 0.6 Mach, accelerate to 0.6 Mach or 300 knots, whichever is less, using altitude and thrust (afterburner if necessary). If range is a consideration, climb at 300 knots minimum until reaching 0.6 Mach, then climb at 0.6 Mach until optimum single–engine cruise altitude. If 0.6 Mach is attained at higher altitude and cannot be maintained at military thrust in level flight, descend at 0.6 Mach until descent stops. If range is a consideration, then descend to optimum single–engine cruise altitude.
2. Land as soon as practical
   Refer to Single–Engine Landing procedure.

AIRSTART

1. Engine master switch – ON
2. Throttle – OFF
3. Ignition button – HOLD PRESSED
4. Throttle – IDLE
   If no fuel flow is observed, slowly advance throttle until fuel flow is noted.
5. If no fuel flow is observed after advancing the throttle, check the main fuel control circuit breakers (H3, J1, No. 2 panel) — RESET
6. Engine rpm, exhaust temperature, oil pressure and fuel flow — MONITOR
   An engine relight is indicated by an increase in exhaust temperature, followed by an increase in engine rpm.

CAUTION

If a relight does not occur within 30 seconds; or the engines do not accelerate after light–off; or the exhaust temperature exceeds its maximum limits; or the oil pressure does not reach its minimum limit; retard the throttle to OFF.

MECHANICAL MALFUNCTION

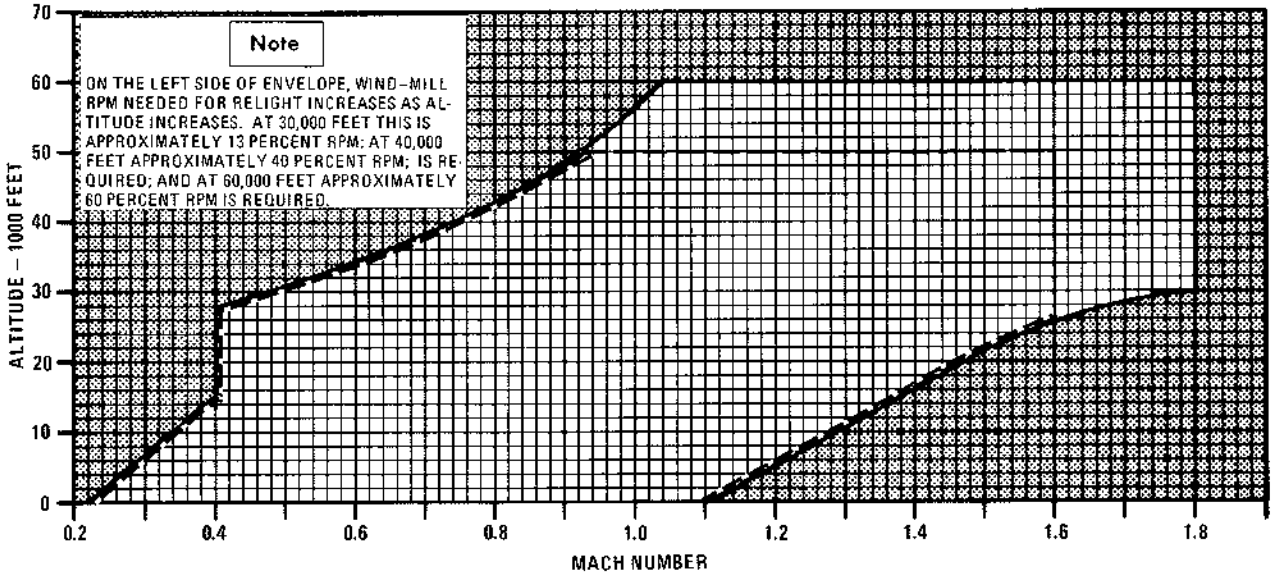
An engine mechanical malfunction is usually accompanied by engine vibrations, explosions, surges, or engine seizure. If one or more of the above symptoms occur, analyze and determine the malfunctioning engine through throttle manipulation and aircraft instruments.

AIRSTART ENVELOPE

ENGINE INFLIGHT STARTING LIMITS

REMARKS

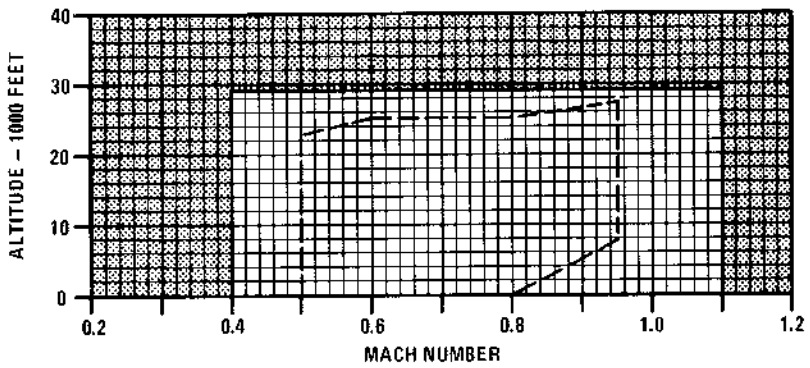
JP-GE-17A/F ENGINE AND
——— JP-4 FUEL
– – – ALTERNATE FUELS



LOW SMOKE ENGINES

REMARKS

J79-GE-17E/G ENGINES
——— JP-4, JP-8, JETA-1 FUELS
– – – JP-5 FUEL



4E-1-(43)C

Figure 3-2

NOTE

Above 30,000 feet, sustained power settings above 90% rpm at subsonic speed with an inlet ramp extended may cause the fire warning light to glow faintly. If this occurs, reduce altitude and power setting as necessary to extinguish the light.

RAMPS CYCLING

A cycling inlet ramp may be detected by a cycling noise or WSO observation. It may be possible to stop the ramp in the retracted position (desirable below 1.5 Mach).

1. Applicable ramp control circuit breaker — PULL (with ramp retracted) (G6, G7 No. 2 panel)

COMPRESSOR STALL

A compressor stall is an aerodynamic disruption of airflow through the compressor, and is caused by subjecting the compressor to a pressure ratio above its capabilities at the existing conditions. The compressor capability may be reduced by FOD, corrosion, rocket/missile motor exhaust, gun gases, misrigged or malfunctioning IGV's. In addition, the compressor may also be subject to abnormal operating conditions as a result of a malfunction of the ramp or bellmouth system. Compressor stalls may be self clearing, may cause the engine to flameout, or may result in a steady state, fully developed stall. The first case requires no immediate action. In the second case, the flameout clears the stall and an airstart is required. The third case requires recognition and corrective action to restore thrust and prevent engine damage by overtemperature.

The stall can be recognized by the simultaneous existence of high EGT, low rpm, low fuel flow, open nozzle, loss of thrust, and lack of engine response to throttle. Compressor stalls may be accompanied by muffled bangs. The most positive stall clearing procedure is to shut down the engine and perform an airstart. In the event of a steady state compressor stall, shut off and restart. A throttle chop to idle may clear the stall if a significant fuel flow reduction from the stall condition is achieved. If the stall is cleared but desired thrust cannot be obtained because of repeated stalling, the engine may be operated at any obtainable rpm, as long as EGT is within limits.

1. Throttle – IDLE

If stall does not clear –

2. Generator switch – OFF
   The generator is turned OFF before placing the throttle OFF to prevent the bus tie from opening when an underspeed occurs as rpm decreases. Turn the generator switch ON after the engine is restarted. After TO 1F-4E-262, turning the left generator off may cause loss of DMAS alignment.
3. Throttle – OFF
4. Inlet ramps – CHECK FULLY RETRACTED
5. Ignition button – HOLD PRESSED
6. Throttle – IDLE
   If throttle position beyond normal cruise setting is used, engine hang-up may occur due to back pressure caused by reduced nozzle area.
7. Engine rpm, exhaust temperature, and fuel flow – MONITOR
8. Generator switch – ON

BLEED AIR DUCT FAILURE/FUSELAGE FIRE

Severe damage to the aircraft may result from a bleed air duct failure due to the high temperature produced by the bleed air system. This air, leaking from a failed duct, may ignite flammable material in the vicinity of the leak and may cause failure of unrelated aircraft systems which have components in the vicinity of the leak. The following symptoms may be indicative of a bleed air system failure: a mild audible thump or bang on the airframe; complete or partial loss of cockpit pressurization; loss of pylons, missiles or other external stores; generator failure, popping of circuit breakers and illumination of several warning/indicator lights; erratic fuel quantity indications; mild stick transients; stiffness of throttles; hydraulic/pneumatic failure; nozzles open; smoke emitting from the intake duct louvers; fuel fumes in the cockpit; high fuel flow/erratic response to throttle movement (indicative of main fuel hose rupture). Make an arrested landing if possible, but do not delay landing waiting for arresting gear.

Complete loss of oxygen and heavy smoke in the cockpit may be due to a bleed air failure/fire in the door 16 or 22 area. Early ejection is recommended if a fire in the door 16/22 area is indicated. The WSO may have to use the Canopy Fails To Separate procedure during the ejection sequence due to fire damage to the rear canopy jettison air bottle.

CAUTION

Early analysis of a bleed air duct failure is required to prevent serious damage or loss of the aircraft and/or to prepare for ejection if the situation rapidly deteriorates.

If several symptoms occur –

1. Attain and maintain safe ejection altitude
2. Reduce power to minimum practicable
3. Oxygen regulator – 100% AND EMERGENCY
   Placing the diluter lever to 100% and the emergency lever to EMERGENCY will provide pure oxygen under positive pressure. This will prevent smoke and fumes from entering the mask even if the mask leaks.

WARNING

The emergency oxygen supply (bailout bottle) does not supply sufficient flow for normal breathing unless the supply hose is disconnected from the CRU-60/P. This action will permit smoke and fumes to enter the mask.

4. Check for indications of fire

If fire confirmed –

5. Eject

If fire not confirmed –

5. Maintain minimum practical power
6. Landing gear – DOWN AS SOON AS PRACTICAL
7. Maintain safe ejection altitude as long as practical
8. Land as soon as possible.
9. **Make an arrested landing (if possible)**

BLEED AIR CHECK VALVE FAILURE

No indication of a bleed air check valve failure will be noted in flight until the throttle is retarded and then readvanced on the engine with the failed bleed air check valve. If the throttle has been retarded and then readvanced, either rpm will hang-up or a minor compressor stall and flame-out will occur at

EJECTION PROCEDURES

BEFORE EJECTION

A. IF TIME AND CONDITIONS PERMIT
- ALERT OTHER CREWMEMBER
- TIGHTEN LAP BELT
- TIGHTEN SEAT KIT STRAPS
- FULLY INSERT OXYGEN MASK BAYONETS
- LOWER HELMET VISORS
- TIGHTEN CHIN STRAP
- ADJUST SITTING HEIGHT IF NECESSARY
- STOW LOOSE EQUIPMENT
- LOCK SHOULDER HARNESS
- NOTIFY CONTROLLING AGENCY

B. SIT ERECT, BUTTOCKS BACK, SHOULDERS AGAINST PARACHUTE PACK, HEAD ERECT, SPINE STRAIGHT, LEGS EXTENDED AND THIGHS ON SEAT CUSHION.

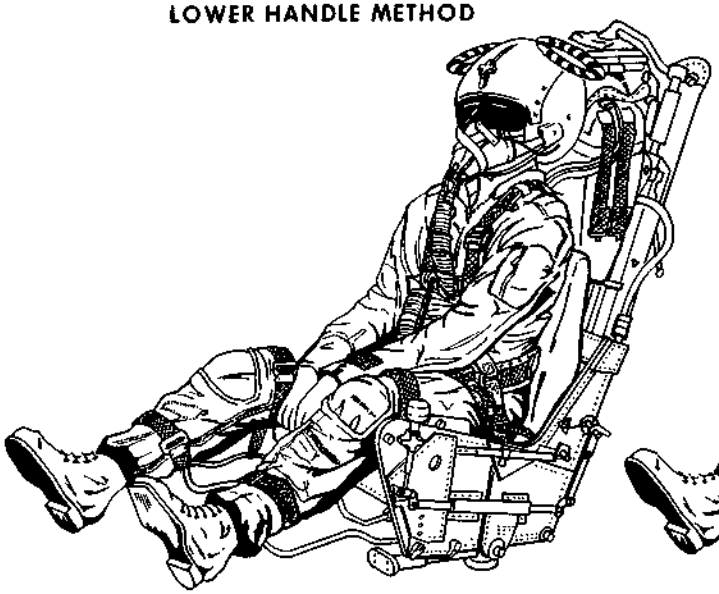
C. THE FORWARD CREWMEMBER WILL NORMALLY INITIATE EJECTION SEQUENCING, HOWEVER, THE AFT CREWMEMBER MAY INITIATE SINGLE OR DUAL SEQUENCING WHEN REQUIRED. THE CREWMEMBER NOT INITIATING THE EJECTION SHOULD BE ALERTED AND ASSUME THE PROPER BODY POSITION WITH HANDS ON THE HANDLE TO AVOID POSSIBLE INJURY.

1. Ejection Handle - PULL

Note

- IF THE CONTROL STICK IN THE REAR COCKPIT IS IN THE FULL AFT POSITION FOR ANY REASON, USE OF THE LOWER EJECTION HANDLE MAY BE RESTRICTED DUE TO INTERFERENCE FROM THE CONTROL STICK. FULL OR NEAR FULL UP SEAT HEIGHT ADJUSTMENT MAY IMPEDE USE OF THE FACE CURTAIN. A COMBINATION OF BOTH THESE CONDITIONS MAY CAUSE DIFFICULTY IN INITIATION OF EJECTION FROM THE REAR COCKPIT.
- ADJUST SEAT SO THAT HELMET IS BELOW THE FACE CURTAIN HANDLES TO ALLOW OPTIMUM BODY POSITION THEREBY MINIMIZING THE POTENTIAL FOR SPINAL INJURY DURING EJECTION.

LOWER HANDLE METHOD

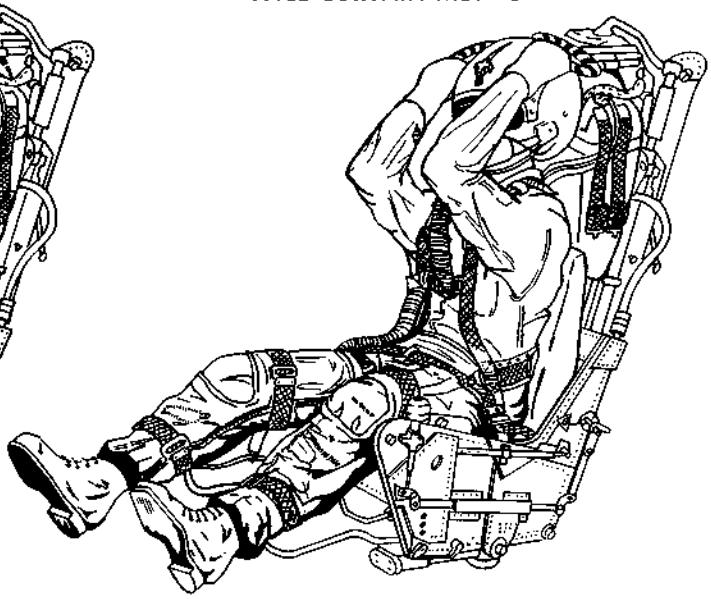


GRASP THE LOWER EJECTION HANDLE USING A TWO HANDED GRIP WITH THE THUMB AND AT LEAST TWO FINGERS OF EACH HAND. PULL STRAIGHT UP ON LOWER HANDLE AND MAINTAIN A CONTINUED PULL. WHEN CANOPY JETTISONS, CONTINUE PULLING UP ON LOWER EJECTION HANDLE UNTIL FULL TRAVEL IS REACHED.

WARNING

FAILING TO PULL THE LOWER EJECTION HANDLE STRAIGHT UP CAUSES BINDING WHICH CAN PREVENT THE LOWER EJECTION HANDLE FROM WITHDRAWING FROM ITS LOCKING DETENT.

FACE CURTAIN METHOD



REACH OVERHEAD WITH PALMS AFT KEEPING ELBOWS SHOULDER WIDTH APART. GRASP FACE CURTAIN HANDLE. PULL FORWARD AND DOWN AND MAINTAIN A CONTINUED PULL. WHEN CANOPY JETTISONS, CONTINUE PULLING FACE CURTAIN UNTIL FULL TRAVEL IS REACHED.

WARNING

ONCE FACE CURTAIN HAS BEEN UTILIZED, DO NOT RELEASE HANDLE. IF THE HANDLE IS RELEASED IT MAY BECOME ENTANGLED IN THE SEAT DROGUE CHUTE DURING THE EJECTION SEQUENCE.

WARNING

IF OUT-OF-CONTROL AT OR BELOW 10,000 FEET AGL, EJECT.
IN CONTROLLED FLIGHT MINIMUM EJECTION ALTITUDE IS DEPENDENT ON DIVE ANGLE, AIRSPEED AND BANK ANGLE.
RECOMMENDED MINIMUM IN CONTROLLED FLIGHT IS 2000 FEET AGL.

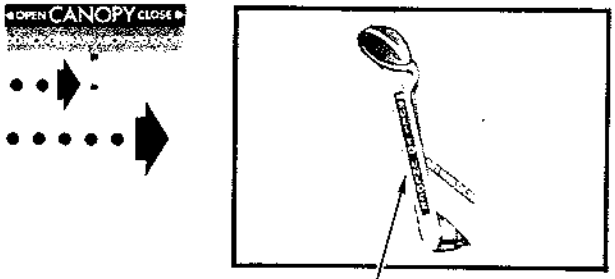
4E-1-175-1153

Figure 3-3 (Sheet 1 of 4)

CANOPY AND EJECTION SEAT FAILURES

CANOPY FAILS TO SEPARATE

1. Continue holding ejection handle without applying tension and keep elbows in toward aircraft centerline.
2. Normal canopy control handle – OPEN
3. Manual canopy unlock handle – PULL



WARNING

With the normal canopy control handle in CLOSED and an operational normal system, it is impossible to unlock the canopy with the manual unlock handle.

If canopy still fails to separate–

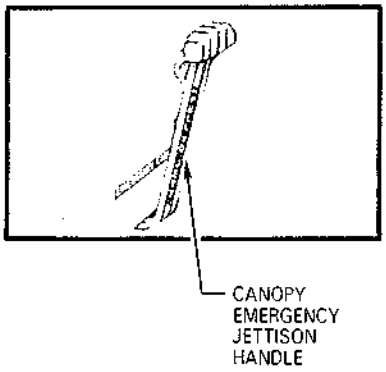
4. Canopy emergency jettison handle - PULL

If canopy still fails to separate–

5. Put negative G's on aircraft and firmly bump forward edge of canopy with heel of hand.

Note

As last resort use canopy breaker knife and follow procedures for ejection seat failure



When canopy separates –

6. Ejection handle – PULL

EJECTION SEAT FAILURE

After canopy separation, if seat fails to fire –

1. Ejection handles - PULL

If seat still fails to fire –

2. Perform manual bailout

MANUAL BAILOUT

1. Canopy – JETTISON
2. Maintain 200–250 knots (if possible)
3. Outside handle (emergency harness release) – LOCK UP
4. Full nose down trim, full rudder trim and opposite aileron trim as required to hold wings level
5. Stick – RELEASE
6. Parachute - DEPLOY (below 10,000 feet)
7. Inside handle (survival kit) – PULL (as applicable)

4E-1-(75-2)M

Figure 3-3 (Sheet 2 of 4)

FUEL TRANSFER FAILURES

INTERNAL WING FUEL FAILS TO TRANSFER

Failure of internal wing fuel to transfer can be caused by the tanks failing to pressurize or the transfer valves failing to open.

1. External transfer switch – OFF
2. Internal wing transfer switch – NORMAL
3. Tank depressurization switch – NORM (some aircraft)
4. Air refuel switch – RETRACT (If retracted, cycle) To cycle the fuel pressurization system without opening the receptacle door, first pull the air refuel receptacle circuit breaker (D1, No. 2 panel), then cycle the air refuel switch.
5. Internal wing fuel transfer control circuit breaker – IN (H2, No. 2 panel)

If fuel still fails to transfer –

6. Reduce airspeed below 250 knots, lower landing gear and check for fuel transfer.
   Failure of fuel to transfer may be the result of malfunctioning landing gear scissors switch which may disable the nose gear steering and/or cause anti–skid system to cut out without warning.

EXTERNAL FUEL FAILS TO TRANSFER

Failure of external fuel to transfer can be caused by the tank shutoff valve failing to the closed position or the tank failing to pressurize.

1. External transfer switch – CENTER/OUTBD
2. Air refuel switch – RETRACT (If retracted, cycle) To cycle the fuel pressurization system without opening the receptacle door, first pull the air refuel receptacle circuit breaker (D1, No. 2 panel), then cycle the air refuel switch.
3. External wing fuel transfer control circuit breaker – IN (J2, No. 2 panel)
4. Fuel valve power circuit breaker – IN (H1, No. 2 panel)

If fuel still fails to transfer –

5. Reduce airspeed below 250 knots, lower landing gear and check for fuel transfer.
   Failure of fuel to transfer may be the result of malfunctioning landing gear scissors switch which may disable the nose gear steering and/or cause anti–skid system to cut out without warning.

If fuel still fails to transfer -

6. External transfer switch – OFF

If single outboard tank fails to transfer -

7. Refer to Contollability Check, this section

FUSELAGE FUEL FAILS TO TRANSFER

A malfunction of the electrical fuel transfer pumps or the fuel level control valves may be indicated by a FUEL LEVEL LOW warning light while fuel on board is sufficient to keep the feed tanks full. A malfunction of the electrical fuel transfer pumps is indicated if one or more of the transfer pump or transfer pump control circuit breakers (D3, E3, F3, G3, D4, E4, F4, G4, No. 2 panel) is popped. A malfunctioning fuel level control valve may prevent pressure fuel transfer even though the hydraulic transfer pumps are operating. Pulling the fuel valve power circuit breaker (H1, No. 2 panel) will ensure that the fuel level control valves in cells 1 and 2 are open and prevents any external fuel from transferring into the fuselage cells.

If complete transfer pump failure or fuel level control valve malfunction occurs, avoid nose high attitudes, high power settings, and minimize longitudinal accelerations. This will allow fuel to gravity feed in sufficient quantities to sustain engine operation. Closely monitor feed tank level to ensure sufficient fuel exists for engine operation. Minimal time should be spent in a climb and a stair-step maneuver is recommended. Should fuel in the feed tank become low, execute a nose low, low power descent. This will allow fuel in cells 4 through 7 to feed through cell 3 to cells 1 and 2. Although the fuel will gravity feed at 15,000 pounds/hour under optimum condtions, recommend reduced power setting if practical. Gravity feed capability is directly dependent on aircraft attitude. For instance, during a 17 unit AOA final approach, half of the fuel in cell 3 and all of the fuel in cells 4 through 7 (5400 pounds aircraft thru 68−494, or 5000 pounds aircraft 68−495 and up) will not gravity feed. In normal cruise approximately 1/2 of the fuel in cells 3 through 7 will not gravity feed. Continually check feed tanks, avoid noise high situations and long final approaches.

1. Feed tank fuel - CHECK
2. If any transfer pump or transfer pump control circuit breaker (D3, E3, F3, G3, D4, E4, F4, G4, No. 2 panel) popped − DO NOT RESET
   Resetting the circuit breakers may result in arcing and cause a fire hazard.
3. Fuel valve power circuit breaker (H1, No. 2 Panel) - PULL
   This ensures that the fuel level control valves in cells 1 and 2 are open.
4. Air refuel switch − EXTEND (320 knots maximum) (monitor fuel gage)
   This ensures hydraulic fuel transfer pump operation. External and internal wing fuel will not transfer with the air refuel switch in EXTEND.
5. Fuel tank fuel − MONITOR
   If gravity feeding, perform a nose low reduced power (low AOA) descent, if practical. This will allow cells 4 through 7 to gravity feed through cell 3 to cells 1 and 2.

When feed tank full -

6. Air refuel switch − CLOSE
   When feed tanks are refilled by the hydraulic transfer pumps, closing the air refuel door will allow external and internal wing fuel to feed.
7. Fuel valve power circuit breaker − IN (H1, No. 2 panel) (if fuselage fuel is still not transferring repeat steps 3 thru 7.)
8. Engines − OPERATE AT MINIMUM POWER FOR SAFE FLIGHT
9. Land as soon as practical
10. Avoid nose high flight conditions
11. Delay slowing to landing configuration to avoid long, high AOA final approach.
12. Fly 17 unit AOA approach

REVERSE FUEL TRANSFER

Reverse fuel transfer from the fuselage tanks to the external tanks can occur if there is a path for the fuel to flow between the fuselage and external tanks. A failed open defuel valve provides such a path. Generally, reverse fuel transfer is not noticeable until the external tanks are depressurized. Reverse fuel transfer occurs most often when the air refuel switch is placed to EXTEND but can also occur when the tanks are depressurized at touchdown or during auto transfer. Reverse fuel transfer is indicated by a rapid decrease in the tape and counter. If reverse fuel transfer occurs on the ground, shut down both engines as soon as practical to prevent flameout while taxiing.

1. Air refuel switch - RETRACT
2. External transfer switch - OFF
3. Refuel selection - INT ONLY
4. Fuel boost pump circuit breakers - PULL
   Aircraft thru 68-494
   a. LH fuel boost pump cont (J4, No. 2 panel)
   b. RH fuel boost pump cont (D2, No. 2 panel)
   Aircraft 68-495 and up
   a. LH fuel boost pump cont (J4, No. 2 panel)

If reverse transfer continues and internal fuel critical -

5. External tanks - JETTISON

FUSELAGE FUEL LEAK

If fuel fumes are detected, an abnormal decrease in fuel quantity is noted, or fuel is observed emitting from the fuselage, a fuselage fuel cell or fuel line rupture may exist. A fuel line rupture may be indicated by abnormal engine operation. In this case, shutting down the engine and turning its master switch OFF may stop the leak. If the engines operate normally or shutting down the suspect engine does not stop the leak, it should be treated as a fuel cell rupture. The greatest danger is a catastrophic fire resulting from ignition of the leaking fuel. If a fire did not occur immediately, it probably will not erupt unless conditions are changed so as to provide an ignition source. The pilot must avoid the normal reaction to land immediately. Instead, he must do as little as possible to change conditions while attempting to stop the leak. All actions should be deliberate and unhurried. Any descent should be gradual to avoid excessive pitch angles, to maintain the recommended airspeed, and to avoid collapsing unpressurized external tanks. Landing should not be attempted until fuselage fuel is reduced below 1800 pounds (fuselage fuel in cells 1 and 2) since lowering the gear will open the auxiliary air doors and cause reverse air flow through the engine bay which may provide an ignition source.

1. Air refuel switch - EXTEND (monitor fuel gage)
   Placing the air refuel switch to EXTEND deactivates the automatic fuel transfer feature, depressurizes all tanks and prevents transfer of internal wing and external tank fuel to the fuselage cells. Fuel transfer is not recommended unless required to prevent flameout due to cell 1 fuel exhaustion. Wing fuel can be dumped normally with the air refuel switch in EXTEND. Placing the internal wing dump switch in DUMP repressurizes the internal wing tanks.
2. Maintain 350 knots
   This airspeed is optimum for ventilation of fuel tank and engine bay areas.

If an engine operates abnormally –

3. Generator bad engine – OFF
   Turn the generator OFF before placing the throttle OFF to prevent the bus tie from opening when an underspeed occurs as rpm decreases.
4. Throttle bad engine – OFF
5. Master switch bad engine – OFF

If engines operate normally or fuel leak continues –

3. Follow Smoke and Fumes procedure, this section (if required).
4. Use minimum bank and pitch angles for maneuvering.
   Maintaining near straight and level flight may reduce fuel spillage.
5. Do not use afterburner.
6. Reduce fuselage fuel below 1800 pounds (if practical).
   The danger of fire or explosion is reduced if all fuselage fuel is in cells 1 and 2.
7. External stores – JETTISON (if required)
8. Make straight-in approach

SINGLE GENERATOR FAILURE

Single generator failure is indicated by illumination of the appropriate GEN OUT light. One generator (with bus tie relay closed) is sufficient to support the entire electrical load.

1. Affected engine instruments – CHECK
   A GEN OUT light may be the first indication of engine failure or CSD failure due to oil starvation. Refer to Oil System failure, this section.

If night or IMC –

2. Generator switch – OFF
3. Oil pressure – MONITOR
4. Land as soon as practical

Day VMC only –

2. Stab aug switches – OFF IF RIGHT GENERATOR FAILED
   If failure of the right generator occurs, disengage the stab aug switches before cycling the generator. This prevents possible control surface transients. After TO 1F–4E–626, turning the left generator switch off may cause loss of DMAS alignment. Without stab aug, do not exceed 300 knots below 10,000 feet and avoid abrupt control movements.
3. Generator switch – CYCLE
   Cycle generator switch from ON to OFF to ON. If the generator fault has been corrected, the generator will be reconnected to the system and the LH/RH GEN OUT light will go out.
4. Stab aug switches – ON

If generator light still on –

2. Generator switch – OFF
3. Oil pressure – MONITOR
   CSD failure due to oil starvation may be the source of trouble and subsequent engine failure could result.
4. Land as soon as practical.

DOUBLE GENERATOR FAILURE

In most cases the generators will not fail simultaneously; it is more likely that one generator will fail, followed by the failure of the other generator. The GEN OUT lights do not illuminate for a double generator failure. However, double generator failure is accompanied by illumination of the DC BUS light. With a double generator failure, boost pump pressure and primary attitude reference systems will be lost. Front cockpit emergency attitude indicator power is supplied from the battery. When power is interrupted, the SPC will disengage. The STATIC CORR OFF light will not illuminate. The CADC switch should be turned off, the telelight panel checked and, after power is restored, the CADC should be reset. If, while performing this procedure, a single generator comes on line, proceed to the Single Generator Failure procedure or the appropriate Bus Tie Open procedure.

CAUTION

With a double generator failure, rudder feel force will automatically revert from 11.5 to 2.6 pounds per degree of rudder deflection. As a result, rudder pedal force at high airspeeds becomes extremely sensitive, and excessive structural loads can be imposed on the aircraft if full rudder deflection is commanded.

1. Reference system selector – STBY
2. Unessential electrical switches – OFF
3. Stab aug switches – OFF
   Without stab aug, do not exceed 300 knots below 10,000 feet and avoid abrupt control movements.
4. Generator switches – CYCLE

If generators come on line –

5. Stab aug switches – ON

If generators do not come on the line –

5. (WSO) Electrical test receptacle plug 3P325 – ENSURE PLUG SEATED FLUSH, KNURLED LOCK RING SECURE, CAP TIGHT.
   It is possible to trip both generators off the line if the electrical test receptacle plug 3P325 under the right canopy sill is loose. The plug uses a knurled (twist clockwise to lock) lock ring which should not be confused with the chain equipped threaded cap.
6. Generator switches – CYCLE

If generators come on line –

7. Stab aug switches – ON

If generators are still inoperative –

7. Generator switch(es) – OFF
8. Land as soon as possible
   Battery life cannot be accurately predicted. Considering the difficulty in recovering the aircraft with complete electrical failure, you should land as soon as possible. With battery power, landing gear and slats flaps operation are normal. If the slats flaps are OUT AND DOWN and the battery fails, the slats will remain out and the flaps will retract to a low-drag trail position.
9. Make a fully configured 17 unit AOA approach
10. Make approach-end arrestment if possible.
11. Anticipate auto-acceleration
    The bellmouths and auxiliary air doors are inoperative. Refer to Auxiliary Air Door Malfunction (Gear Down) this section.

BUS TIE OPEN

An illuminated BUS TIE OPEN light is an indication that the right and left generator bus systems are no longer interconnected. If the left generator is disconnected and the bus tie relay is open, the left main ac buses will be lost. If the right generator is disconnected and the bus tie relay is open, the right main ac buses are lost. Refer to Emergency Power Distribution charts to determine affected systems. During night or IMC, consideration should be given to the possible loss of additional electrical power due to cycling a generator.

BUS TIE OPEN (BOTH GENERATORS OPERATING – NIGHT OR IMC)

1. Land as soon as practical

BUS TIE OPEN (BOTH GENERATORS OPERATING – DAY VMC)

In day VMC conditions, a BUS TIE OPEN light with both generators operating should not necessitate aborting the mission if the bus tie can be closed by cycling a generator switch. The bus tie cannot be closed if the DC BUS light is on and the main 28 vdc bus is inoperative. In most cases the bus tie can be closed by cycling a generator. If the bus tie remains open after generator cycling, an out of phase/frequency condition exists. Therefore, it is possible to create an undesirable difference frequency oscillation which may impair performance of systems utilizing inputs derived from both generators. In day VMC conditions, the irregularities may be eliminated by turning a generator off and thus supplying the same phase/frequency to all systems. The utility power dc circuit breaker must be IN before the bus tie relay can be closed. If the circuit breaker is out and will not reset, cycling and/or turning off a generator will not close the relay and in fact will cause interruption of power to the applicable busses as long as the generator switch is off. In view of the above, proceed as follows:

1. Utility power dc circuit breaker – IN/CYCLE IF IN (D5, No. 2 panel)

If circuit breaker will not reset –

2. Land as soon as practical

If circuit breaker in or resets and BUS TIE OPEN light still on –

2. Stab aug switches – OFF
   The stab aug switches should be disengaged before cycling the generator switch to prevent possible control surface transients. Without stab aug, do not exceed 300 knots below 10,000 feet and avoid abrupt control movements.
3. Right generator – CYCLE

If BUS TIE OPEN light goes out –

4. Stab aug switches – ON

If BUS TIE OPEN light stays on –

4. Right generator – OFF

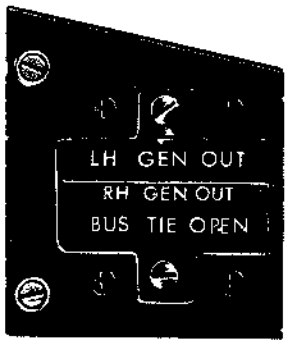
If BUS TIE OPEN light goes out –

5. Stab aug switches – ON
6. Land as soon as practical

If BUS TIE OPEN light still on –

5. Right generator – ON
6. Stab aug switches – ON
7. Land as soon as practical

EMERGENCY POWER DISTRIBUTION



INOPERATIVE EQUIPMENT

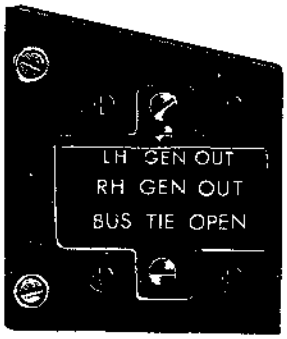
LH Gen Out-Bus Tie Open

CRITICAL ITEMS

ANTI-ICE
ANTI-SKID
AFTERBURNER IGNITION (RIGHT & LEFT)
8 DIGITAL MODULAR AVIONICS SYSTEM
22 13 INS HEATER
23 INU HEATER
LANDING LT
23 NAVIGATION & WEAPON DELIVERY SYSTEM (NWDS)

NON-CRITICAL ITEMS

AN/ARW-77
ANTI-COLLISION LT (ONE FILAMENT)
5 CORDS HTR
10 CORDS PWR
9 DSCG
ECM PODS (STA 2, 4, & 5)
EQPT COOLING
FUSLG LTS
FRONT CKPT CONSOLE LTS
FRONT CKPT RED INSTR FLOODS (DIM)
L COSS
LH 28V TRANSFORMER
12 LH FUEL BOOST PUMP
LH MISSILE FIRING
LH MISSILE POWER
LH TRANSFORMER RECTIFIER
NO. 4 ELEC FUEL XFR PUMP
NOSE GUN
RADAR
RADAR SCOPE CAMERA
RED CONSOLE FLOODS MED
11 RH FUEL BOOST PUMP
RH MISSILE PWR
SEAT ADJUST
SHRIKE GUIDANCE
TARGET DESIGNATOR
UTILITY LT
UTILITY PWR AC
WING AND TAIL LT DIM
22 13 WRCS PWR



INOPERATIVE EQUIPMENT

RH Gen Out-Bus Tie Open

CRITICAL ITEMS

AIRSPEED PITOT HEATER
AOA PROBE HEATER
BELLMOUTH PITOT HTR
CKPT HEAT & VENT
17 FUEL QUANTITY INDICATOR
IFF
REAR COCKPIT CI HEADING POINTER
TACAN
VOR: BEARING POINTERS

NON-CRITICAL ITEMS

ADF
AILERON FEEL TRIM
AILERON RUDDER INTERCONNECT
3 ALR-46 WARNING SYS
ALTITUDE ENCODER
ANTI-COLLISION LT (ONE FILAMENT)
6 APR-36/37
7 APU
APX-80 A/A IFF
ARMAMENT PWR
AUTOPILOT
AUX RECEIVER
24 CADC
5 CORDS PWR
ECM PODS (STA 6 & 8)
FORM LTS
FRONT CKPT INSTR LTS
GUNSIGHT CAMERA
2 IFR RCPT FLOOD LTS
11 LH FUEL BOOST PUMP
L ENGINE RAMP CONT
NO. 6 ELEC FUEL XFR PUMP
OXYGEN GAGE
21 RADAR ALTIMETER
RIGHT ENGINE RAMP CONT
RH 28V TRANSFORMER
1 RWR PWR
12 RH FUEL BOOST PUMP
RH TRANSFORMER RECTIFIER
25 SCADC
STAB AUG
TAXI LT
WINDSHIELD TEMP SENSING
WING & TAIL LT BRT

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Figure 3-7 (Sheet 1 of 2)

EMERGENCY POWER DISTRIBUTION

INOPERATIVE EQUIPMENT

Main 28 Volt DC Bus Out

CRITICAL ITEMS

ANTI-SKID
BUS TIE RELAY (BUS TIE OPEN LT ON)
CKPT HEAT & VENT
INTERNAL WING FUEL PUMP
LANDING & TAXI LTS
NOSE WHEEL STEERING
TACAN
TURN & SLIP INDICATOR (REAR CKPT)

NON-CRITICAL ITEMS

ACM IN RANGE AND SHOOT LIGHTS
ACOUSTICAL SCORER (A/A 37U-33)
ADF
AGTS (A/A37U-36)
AILERON RUDDER INTERCONNECT
4 AIRBORNE VIDEO TAPE RECORDER (AVTR)
ALE-40
ALTIMETER VIBRATOR
6 APR-36/37
7 APU
APX-80 A/A IFF
ARRESTING HOOK (UP OPERATION)
AUX AIR DOORS
AUX RECEIVER
16 COMBAT DOCUMENTATION CAMERAS
CONVENTIONAL WEAPONS RELEASE & FIRE
10 CORDS PWR
9 DSCG
ECM CONTROL
ECM PODS & DESTRUCT (STA 2, 4, 5, 6 & 8)
ENG VARIABLE BELLMOUTH
EQPT COOLING CONTROL
FUSLG, ANTI-COLLISION & TAIL LTS
GUNSIGHT CAMERA
LCOSS
LH FUEL BOOST PUMP
MISSILE FIRING
22 13 NAV COMPUTER
NO. 4 ELEC FUEL XFR PUMP
NO. 6 ELEC FUEL XFR PUMP
NOSE GUN
PNEUMATIC COMPRESSOR
RADAR
RADAR ALTIMETER
RAIN REMOVAL
RADAR SCOPE CAMERA
1 RWR PWR
RH FUEL BOOST PUMP
13 RMU-8/A (NORMAL OPERATION)
RUDDER TRIM/BELLMOUTH CONT
SPEED BRAKE
SPECIAL WEAPONS ℄ ARM
STABILATOR POSITION INDICATOR
STATION & SELECT LTS
TARGET DESIGNATOR
UTILITY POWER D-C
VGH RECORDER POWER D-C
14 ★ VOICE WARNING (ALTITUDE FUNCTION ONLY)
WALLEYE INDENT POWER
WARNING LIGHTS DIM
22 13 WRCS POWER

OPERATIVE EQUIPMENT

Battery Power Only

CRITICAL ITEMS

AOA INDICATOR
EGT INDICATORS
EJECTION LIGHT
EMER ATTITUDE IND
★ ENGINE FIRE & OVERHEAT DETECTOR
EXT FUEL XFR (CONTROL)
FLAPS/SLATS CONTROL
FLAPS/SLATS POSITION IND
18 FUEL QUANTITY INDICATOR
ILS: CDIs, GLIDE SLOPE INDICATORS, AUDIO, AND MARKER BEACON
INFLIGHT REFUELING
INTERCOM
INT WING FUEL XFR (CONTROL)
LANDING GEAR CONTROL
LANDING GEAR POSITION INDICATOR
LEFT & RIGHT MAIN IGNITION
STABILATOR FEEL TRIM
15 UHF COMM RECEIVER-TRANSMITTER
VOR: CDI, TO-FROM, AND AUDIO
WHITE FLOOD LIGHT

NON-CRITICAL ITEMS

ALL STORES EMER JETT
AOA AURAL TONE GENERATOR
FUEL CONTROL
FUEL VALVE POWER
FRONT CKPT INSTR FLOODS BRT
GUARD RCVR
19 KY-28
20 KY-58
MISSILE FAIRING
MISSILE JETT
NOZZLE POSITION INDICATOR
OUTBOARD STATION JETT
13 RMU-8/A EMER POWER
SPECIAL WEAPONS ℄ SAFE
SPECIAL WEAPONS UNLOCK
TOW CABLE RELEASE (A/A 37U-33)
TRIM CONTROL

★ TEST FUNCTION INOPERATIVE

1 AIRCRAFT 66-368 THRU 68-538
2 AIRCRAFT 67-220 AND UP
3 AFTER TO 1F-4E-591
4 AFTER TO 1F-4E-639 OR TO 1F-4-1138
5 AIRCRAFT 66-284 THRU 68-409
6 AIRCRAFT 66-284 THRU 72-1497
7 AIRCRAFT 68-452 AND UP
8 AFTER TO 1F-4E-626
9 AFTER TO 1F-4E-611
10 BEFORE TO 1F-4E-611
11 AIRCRAFT 66-284 THRU 68-494
12 AIRCRAFT 68-495 AND UP
13 BEFORE TO 1F-4E-626
14 AFTER TO 1F-4-1262
15 BEFORE TO 1F-4-1233, THE COMM FUNCTION SELECTOR MUST BE IN T/R, T/R+G, OR G AND MANUAL FREQUENCY SELECTION IS REQUIRED. AFTER TO 1F-4-1233, UHF OPERATES NORMALLY. SEE UHF RADIO, SECTION I.
16 AIRCRAFT 69-7579 AND UP
17 BEFORE TO 1F-4-1414
18 AFTER TO 1F-4-1414
19 BEFORE TO 1F-4-1320
20 AFTER TO 1F-4-1320
21 AFTER TO 1F-4-1252, WITH CARA RADAR ALTIMETER NOT AFFECTED.
22 BEFORE TO 1F-4E-671
23 AFTER TO 1F-4E-671
24 BEFORE TO 1F-4-1355
25 AFTER TO 1F-4-1355

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Figure 3-7 (Sheet 2 of 2)

LEFT GENERATOR OUT – BUS TIE OPEN

1. Left engine instruments – CHECK
   A GEN OUT light may be the first indication of engine failure or CSD failure due to oil starvation. Refer to Oil System Failure, this section.
2. Left generator switch – CYCLE
   If the LH GEN OUT and BUS TIE OPEN lights stay on, the left main ac buses will be lost.
3. NCSC INS knob — ATTD (DMAS)

If INU fault indicated (NWDS) -

4. Refer to NWDS Failures (ACU, AIU, CDU, or INU) this section.

If LH GEN OUT and BUS TIE OPEN lights stay on -

4. Left generator switch – OFF
5. Unessential electrical equipment – OFF
   Turn off all electrical equipment not essential to flight. Refer to Emergency Power Distribution chart.
6. Left engine oil pressure – MONITOR
   CSD failure due to oil starvation may be the source of trouble and subsequent engine failure may result.
7. Land as soon as practical
8. Make a fully configured 17 unit AOA approach
9. Consider an approach–end arrestment
   Anti–skid is inoperative
10. Avoid heavy braking

RIGHT GENERATOR OUT – BUS TIE OPEN

A right generator out and bus tie open will cause random flight control inputs which can be as much as 15° rudder, 11° spoiler, and ½° stabilator deflection. Actuation of the emergency quick release lever or disengagement of stab aug switches and ARI will correct this but it may take as long as 8 seconds before all surfaces return to neutral. This delay may be interpreted as additional uncommanded input. Any momentary re–engagement will again cause another random input. The amount, rate of deflection, and rate of correction is neither predictable nor repeatable.

1. Emergency quick release lever – HOLD PRESSED
2. Right engine instruments – CHECK
   A GEN OUT light may be the first indication of engine failure or CSD failure due to oil starvation. Refer to Oil System Failure, this section.
3. Stab aug switches – OFF
   The stab aug switches should be disengaged before cycling the generator switch to prevent possible control surface transients. Without stab aug, do not exceed 300 knots below 10,000 feet and avoid abrupt control movements.
4. ARI circuit breaker (front cockpit) – PULL
   With the ARI circuit breaker pulled, anti–skid is inoperative.
5. Emergency quick release lever – RELEASE
6. Right generator switch – CYCLE
   If the RH GEN OUT and BUS TIE OPEN lights stay on, the right main ac bus will be lost.

If RH GEN OUT LIGHT or BUS TIE OPEN light out -

7. Stab aug switches – ON
8. ARI circuit breaker – RESET

If RH GEN OUT LIGHT and BUS TIE OPEN lights stay on -

7. Right generator switch – OFF
8. Right engine oil pressure – MONITOR
   CSD failure due to oil starvation may be the source of trouble and subsequent engine failure may result.
9. Land as soon as practical
10. Make a fully configured 17 unit AOA approach
11. Consider approach–end arrestment
12. Avoid heavy braking
    With the ARI circuit breaker pulled, anti–skid is inoperative.

DC BUS LIGHT ON

The DC BUS light comes on when the main dc bus and essential dc bus are disconnected. If the light should come on, check operation of equipment powered by each bus to determine its condition. Operate the speed brakes to check the main dc bus. Failure of the essential dc bus will cause the gear indicators to barberpole when the battery bypass switch is placed ON.

1. **Speedbrake — CYCLE (to check the main 28 vdc bus)**
2. **Battery bypass — ON (to check the essential 28 vdc bus)**
   Failure of the essential dc bus will cause the gear and flap indicators to barberpole when the battery bypass switch is placed to ON.
3. **Battery bypass - OFF**

IN DAY VMC CONDITIONS —

1. **Stab aug switches — OFF**
2. **Reference system selector — STBY**
3. Generator switches — CYCLE SIMULTANEOUSLY

NOTE

- After TO 1F−4E−626, cycling the left generator may cause loss of DMAS alignment.
- After TO 1F−4E−671, cycling the left generator may cause ACU failure which will result in the CDU displaying the ACU FAILURE INU BACKUP NAV DISPLAY. The INU will remain aligned and navigating unless the INU NWDS power switch is cycled. Refer to TO 1F−4E−34−1−1−3.

4. Stab aug switches — ON
5. Equipment operated by both dc buses — RECHECK

IF DAY VMC AND DC BUS LIGHT REMAINS ON OR NIGHT IMC

Both buses operating - DC BUS light on -

1. Land as soon as practical

Main DC bus failed - DC BUS light on (speed brake inop) -

1. Land as soon as practical
2. Make a fully configured 17 unit AOA approach
3. Make an approach end arrestment, if possible
   Anti-skid and nose wheel steering are inoperative. Refer to approach end arrestment this section.
4. Avoid heavy braking

ESSENTIAL BUS FAILED (WITH OPERATIVE BATTERY) - DC BUS LIGHT ON -

1. Land as soon as possible
2. Anticipate battery failure
   If unable to land immediately, battery life may be extended by placing the battery bypass switch to ON until in a position to make a safe approach and landing. Those items listed in the emergency power distribution chart under Operative Equipment Battery Power Only are powered by the essential dc bus and battery bus and will be lost while the battery bypass is ON or when the battery fails.
3. Configure as soon as practical
   Battery life cannot be accurately predicted. Without battery power, normal landing gear and slats/flaps controls are inoperative. If the slats/flaps are out and down and the battery fails, the slats will remain out and flaps will retract to a low drag trail position. Other critical items which will be lost include: intercom, AOA system, gear and slats/flaps indicators, EGT indicators, UHF radio and the internal and external wing transfer.
4. Fly computed fully configured on speed +10 knots approach

ESSENTIAL BUS FAILED (BATTERY FAILED) - DC BUS LIGHT ON -

1. Land as soon as possible
2. Make a straight in, no slat/flap approach
   Refer to no slats/flaps landing this section.

CAUTION

Without battery power, normal slats/flaps extension is not available. The emergency slats/flaps extension system should be activated only if the utility system fails. If the emergency system is activated with normal utility hydraulic pressure available, there is a high probability of losing utility hydraulic system pressure.

3. If gear not down and locked — BLOW DOWN
   Refer to landing gear emergency lowering (utility hydraulic or electric system failed) this section.
4. Fly approach at the airspeed shown below:

GROSS WEIGHT	APPRCH SPEED GEAR DOWN
34,000	166
35,000	168
36,000	170
37,000	172
38,000	174
39,000	176
40,000	178
41,000	180
42,000	182
43,000	184
44,000	186
45,000	188
46,000	190

FLIGHT CONTROL MALFUNCTION

Upon initial detection of any abnormal flight control movement, immediately press the emergency quick release lever and hold in order to determine if the stab aug or AFCS was causing the abnormality.

1. Emergency quick release lever — HOLD PRESSED
   It may take up to 8 seconds for an aileron or rudder input to cease after depressing the emergency quick release lever or turning the appropriate roll or yaw stab aug off.
2. AFCS - DO NOT ENGAGE
3. Stab aug switches - AS REQUIRED
4. Emergency quick release lever - RELEASE

NOTE

With pitch aug disengaged or inoperative, do not exceed 300 knots below 10,000 feet, and avoid abrupt control movements.

3. Maintain attitude and airspeed during steps 4 through 6.
4. NCSC INS knob – NAV (Check ALIGN light ON and NAV light OFF).
5. KC keyboard – PERFORM POWER CHECKS.
6. When ALIGN light goes out and NAV light comes ON in 1 to 2 minutes, resume aircraft maneuvers.
7. Reference system selector switch – PRIM.

NOTE

The NSC NAV light will remain on as a reminder that only INS attitude information is valid. Check position and perform position update as needed before loran lock–on.

8. Monitor DDI NO SIG and NEW STA lights go out to indicate loran lock–on (loran lock–on is necessary for a complete gyro compass alignment).
9. NCSC mode knob – LRN INT.
10. When NAV light goes out, IMU has full gyro compass alignment.

NWDS FAILURES (ACU, AIU, CDU, OR INU)

NWDS provides backup modes for limited operation should NWDS components fail. Figure 3–9A lists component failures and backup NWDS control and display capabilities.

NOTE

All radio navigation functions (VOR/ILS and TACAN) are available with a NWDS failure by selecting the desired mode on the NFSP MODE knob.

To verify heading information –

1. Reference system selector – STBY
   Verify that the aircraft heading will sync to the correct mag heading. This may be cross checked against the NWDS by selecting the Emergency Data screen, and comparing the instrument reading with mag heading displayed on the CDU.

Verify type of failure –

1. LRU status display – SELECT (SFT, cursor on top)
   a. If D94 display present, refer to ACU Failure.
   b. If AIU faulted, refer to AIU Failure
   c. If CDU blank or BIT light on, refer to CDU Failure.
   d. If INU faulted, refer to INU Failure.

ACU FAILURE

If the ACU fails, the INU takes over bus control for the NWDS system and continues to supply attitude, heading, and navigation data to the flight director system, and allows display of the ACU Failure/INU Backup Nav Display (refer to TO 1F–4E–34–1–1–3). The CDU will display destination 94 and current latitude, longitude, and groundspeed. The value of the winds and groundspeed is the current values that the INU is calculating.

The CDU issues commands to the INU to recall destination latitudes and longitudes. The WSO can recall destination (95 thru 99) for review. The CDU will replace the cursor in the destination window and allow the WSO to enter the destination number. The CDU will then display the latitude and longitude for the entered destination number.

The CDU is capable of issuing a Fly–To command to the INU. Pressing the Fly–To key followed by the ENT key will command the INU to Fly–To the displayed destination.

The WSO may recall destinations 95 thru 99 and modify the latitude and/or longitude by pressing L1 for latitude or R2 for longitude. Pressing the ENT key after entering the values will send the new value to the INU for storage. The WSO may leave destinations 95 thru 99 unmodified and input a new destination by modifying the destination number to 100. Latitude and longitude for destination 100 can then be entered. This allows the WSO to repeatedly input destinations as the flight progresses without loosing the special destination data (95 thru 99).

If backup NAV display present –

1. D100 – SELECT (R1, 100, ENT)
2. Latitude/longitude – MODIFY (as required) (L1 or R2, modify data, ENT)
3. Fly to D100 (D, ENT)
4. Recovery destination – SELECT (R1, D95–99, ENT, D, ENT)
5. Refer to backup navigation capabilities (figure 3–9A)

AIU FAILURE

The AIU provides the interface between the NWDS and the other aircraft equipment. With an AIU failure communication of NWDS data to the other aircraft equipment is lost, and therefore all NWDS aided functions are lost. NWDS will continue to operate and to navigate, however CMPTR APR flight director functions are not available (limited navigation steering functions are available). All radio navigation functions (VOR/ILS and TACAN) are available by selecting the desired mode on the NFSP MODE knob. It may be possible to recover a failed AIU by reconfiguring the AIU.

1. LRU status display – SELECT (SFT, cursor on top)
   With an LRU failure indicated (MC in upper right corner of the CDU), pressing the shift cursor on top sequence will display the LRU status screen.
2. Verify AIU failed – REVERSE HIGHLIGHTED X FOLLOWING AIU LEGEND
3. Configuration screen selected (SFT, PMD, L1, F2, F4) – TOGGLE PAVE SPIKE (L2, L2)
4. Verify AIU fault cleared (SFT, cursor on top) – NONREVERSE HIGHLIGHTED X FOLLOWING AIU LEGEND

If fault not cleared –

5. Refer to backup navigation cabapilities (figure 3–9).

CDU FAILURE

If a CDU failure occurs after system initialization, additional NWDS CDU data display or entry/modification is not possible. If NWDS is navigating, the preplanned mission data flight plan can be flown as entered without further modification. If deviations from the available NWDS flight plan are required, the CMPTR NAV function of the flight director will not be available. Placing the NFSP MODE knob to CMPTR APR will, after 5 seconds, sequence the NWDS to destination 95 and provide approach and landing steering to destination 95 on the ADI. All other NWDS functions will continue normally.

When steering required to D95 -

1. Navigation function selector switch – CMPTR APR

INU FAILURE

If the INU fails, with the Reference System Selector Switch in PRIM, NWDS will automatically supply AN/AJB–7 attitude data to the ADI. Since the ADI is now using AN/AJB–7 attitude data, no additional attitude accuracy will be gained by changing Reference System Selector Switch position. But placing the switch to STBY is required to obtain reliable heading information.

NOTE

- NWDS operating with the NWDS power switch in the NWDS position will navigate using the Dead Reckoning (DR) mode as an INU failure backup. DR mode can also be selected by placing the CDU Mode Select Switch to the DR position.
- A Backup Navigation mode advisory will occur each time the INU is placed into an alignment mode. This does not indicate failure of the system.

The Dead Reckoning (DR) mode navigation function is a backup to the inertial navigation capability following an INU failure and will not run concurrent with the INU navigation functions. In the DR navigation modes, the ACU uses TAS from the SCADC, heading from the AN/AJB–7 and attitude from the INU (if available) or fixed values of zero degrees pitch and zero degrees roll (if the INU has failed) to perform navigation computations. Last valid winds or WSO entered winds are used to compute groundspeed.

In DR navigation, emergency data is used whenever it is entered. DR navigation will compute present position based on the last available valid data until the operator manually enters true airspeed, wind, altitude, magnetic variation and/or heading via the Emergency Data Display. NWDS does a data reasonableness check on the data entered by the WSO, and if the data fails to check, it is displayed in reverse video.

NOTE

In DR navigation, position updates may be accomplished if required.

EMERGENCY DATA DISPLAY

The Emergency Data Display is selected from the Navigation Menu Display by pressing L3. (Refer to TO 1F–4E–34–1–1–3.) The data displayed consists of the following:

a. Altitude
b. True Airspeed
c. Wind Direction/Velocity
d. Magnetic Heading
e. Magnetic Variation

A window in front of each data entry will display C (for calculated value) or E (for WSO entered emegency value) indicating the source of the data displayed.

If the INU is faulted and the aircrew wants to have it back as an attitude system, they may complete an inflight alignment. The INU will then be good for attitude only. The DR Navigation mode will continue to process position. See INU Inflight Alignment.

If INU fault verified (reverse highlighted X) -

1. Inflight alignment – INITIATE (if required)
2. Emergency Data Display – SELECT (SFT, PMD, L3)
3. Manual data – INPUT (as required)

If not verified as an INU failure -

4. Assume NWDS failure and leave power switch in INU/NWDS to retain attitude

INU INFLIGHT ALIGNMENT

If it is necessary to perform an inflight alignment to provide attitude information, proceed as follows:

1. Reference system selector knob – STBY
2. Power switch – NWDS FOR 5 SECONDS
3. Aircraft straight and level
4. Power switch – INU/NWDS
   Maintain straight and level attitude for 15 seconds. Perform additional inflight alignments as required.
5. Reference system selector – PRIM

NWDS SYSTEM ADVISORY MESSAGES

An abbreviated listing of NWDS advisory messages, their cause, and the operator action associated with each message are contained in figure 3–9B.

CANOPY DAMAGE/LOSS

If a canopy is damaged or lost, especially as the result of a bird strike or other external factor, consider the following in determining the proper course of action: aircraft control, terrain avoidance, ejection seat damage, possibility of an uncommanded eject light, and impaired intercom/radio communications. If feasible, slow to 250 knots and lower the ejection seats to reduce windblast and

improve communications. If applicable, refer to Landing From The Rear Cockpit With Pilot Disabled. It is imperative that WSO experience/abilities be considered before a back seat landing is attempted. After landing, do not open canopy until the ejection seats have been verified safe by egress personnel.

CONTROLLABILITY CHECK

During any inflight emergency, except utility hydraulic and engine failure, when structural damage or any other failure is known or suspected that may adversely affect aircraft handling characteristics, a controllability check should be performed as follows:

1. Proceed to a safe altitude (minimum 5000 feet AGL).
2. Reduce gross weight to minimum practical.
3. Landing gear – DOWN
4. Slats flaps – OUT AND DOWN
   (without structural damage)
   – NORMAL AND SLATS OVERRIDE SWITCH IN
   (with structural damage)
5. Slow aircraft to determine the airspeed that produces acceptable approach and landing handling characteristics, no slower than 17 units AOA.

NOTE

- For aircraft with asymmetrical load, airspeed should be no slower than that at which full aileron trim will maintain wings level.
- With an asymmetric load near 17,000 foot–pounds (1,500 pounds on station 1 or 9 or 2,500 pounds on 2 or 8), landing with a crosswind component over 10 knots from opposite the heavy wing is not recommended.
- Arresting gear limitations and field conditions must be considered.

If adequate control is not available due to asymmetric load –

6. Asymmetric load – JETTISON (refer to Jettison Chart)

If adequate control is available –

6. Maintain landing configuration and make straight–in approach.
7. Enroute to final approach, fly no slower than 230 knots with gear down and flaps up; or 200 knots with gear down and slats out flaps down.
8. Fly final approach no slower than minimum control airspeed determined during controllability check.
9. Do not flare during landing.

HSI NWDS BACKUP NAVIGATION CAPABILITIES (WITH NWDS COMPONENT FAILURES)

NOTE

NWDS COMPONENT FAILURES DO NOT AFFECT VOR/ILS/TACAN EQUIPMENT OPERATION IN TERMS OF THE NAVIGATION CAPABILITIES OF THE HSI.

NWDS DRIVEN HSI CAPABILITIES	ACU FAILURE	INU FAILURE	AIU FAILURE	CDU OR DTU FAILURE
BEARING POINTER (2, FIGURE 1-15)	FULL CAPABILITY	FULL CAPABILITY BASED ON AN/AJB-7	FULL CAPABILITY	All HSI CAPABILITY RETAINED
HEADING MARKER (6, FIGURE 1-15)	FULL CAPABILITY	FROM AN/AJB-7	FULL CAPABILITY	
MODE LIGHT (TGT)	LOSE FUNCTION	FULL CAPABILITY	LOSE FUNCTION	
COURSE DEVIATION INDICATOR	LOSE FUNCTION	FULL CAPABILITY BASED ON AN/AJB-7	LOSE FUNCTION	
RANGE INDICATOR	FULL CAPABILITY	LOSE FUNCTION	FULL CAPABILITY	
TO-FROM INDICATOR	FULL CAPABILITY	LOSE FUNCTION	LOSE FUNCTION	
COURSE SET KNOB	FULL CAPABILITY 1	LOSE FUNCTION	LOSE FUNCTION	
DISTANCE SHUTTER	LOSE FUNCTION	SHUTTERS CLOSE	LOSE FUNCTION	

1 PILOT CAN SET COURSE SET KNOB, BUT WILL ONLY BE USED FOR CMPTR NAV AND CMPTR APR.

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Figure 3-9A (Sheet 1 of 2)

ADI NWDS BACKUP NAVIGATION CAPABILITIES (WITH NWDS COMPONENT FAILURES)

NOTE

NWDS COMPONENT FAILURES DO NOT AFFECT VOR/ILS/TACAN EQUIPMENT OPERATION IN TERMS OF THE NAVIGATION CAPABILITIES OF THE ADI.

NWDS DRIVEN ADI CAPABILITIES	ACU FAILURE	INU FAILURE	AIU FAILURE	CDU OR DTU FAILURE
1. BANK STEERING BAR 2. GLIDE SLOPE INDICATOR 3. GLIDE SLOPE WARNING FLAG 4. ATTITUDE WARNING FLAG 5. PITCH STEERING BAR	LOSE ADI FUNCTIONS 1 THRU 5	RETAIN ADI FUNCTIONS 1 THRU 5	LOSE ADI FUNCTIONS 1 THRU 5	RETAIN FULL ADI FUNCTIONS
6. ADI PITCH & ROLL	PITCH & ROLL UNAFFECTED	PITCH & ROLL DATA PROVIDED BY AN/AJB-7 (IF AVAILABLE)	PITCH & ROLL UNAFFECTED	

BDHI NWDS BACKUP NAVIGATION CAPABILITIES (WITH NWDS COMPONENT FAILURES)

NOTE

NWDS COMPONENT FAILURES DO NOT AFFECT VOR/ILS/TACAN EQUIPMENT OPERATION IN TERMS OF THE NAVIGATION CAPABILITIES OF THE BDHI.

NWDS DRIVEN BDHI CAPABILITIES	ACU FAILURE	INU FAILURE	AIU FAILURE	CDU OR DTU FAILURE
POINTER NO. 1 (SINGLE BAR POINTER) (BEARING)	FULL CAPABILITY (DRIVEN BY INU)	FULL CAPABILITY BASED ON AN/AJB-7	FULL CAPABILITY (DRIVEN BY INU)	RETAIN FULL BDHI FUNCTIONS
HEADING	FULL CAPABILITY	BACKUP HDG FROM AN/AJB-7	FULL CAPABILITY	
DISTANCE	FULL CAPABILITY	LOSE DIST FUNCTION	FULL CAPABILITY	
POINTER NO. 2 (DOUBLE BAR POINTER) (BEARING OR DRIFT)	LOSE CAPABILITY	FULL CAPABILITY	LOSE FUNCTION	
1000 MILE FLAG	LOSE FUNCTION	LOSE FUNCTION	LOSE FUNCTION	
DISTANCE SHUTTERS	LOSE FUNCTION	SHUTTERS CLOSE	LOSE FUNCTION	

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Figure 3-9A (Sheet 2 of 2)

ADVISORY MESSAGES

THE FOLLOWING MESSAGES ARE DISPLAYED ON THE ADVISORY DISPLAY WHEN NWDS DETECTS A FAULT:

MESSAGE	CONDITION	OPERATION ACTION
ACU OVERTEMP	ACU OVERHEAT FAULT	CLEAR MESSAGE. ACU MAY FAIL. TURN NWDS OFF IF NOT ESSENTIAL FOR MISSION.
ACU POWER SUPPLY	ACU POWER SUPPLY FAULT	CLEAR MESSAGE. ACU MAY FAIL. TURN NWDS OFF IF NOT ESSENTIAL FOR MISSION.
ADI DATA	ADI STEERING DATA MAY BE VALID	CLEAR MESSAGE. ADI STEERING INDICATIONS MAY BE IN ERROR.
AHRS DATA	NOT IN DR MODE OR AHRS MAGNETIC HEADING IS INVALID	CLEAR MESSAGE. IF IN DR MODE, LAST GOOD MAGNETIC HEADING WILL BE USED UNTIL A NEW VALUE IS ENTERED ON THE EMERGENCY DATA SCREEN.
AIR DATA NO-GO	AIR DATA MAY BE INVALID	CLEAR MESSAGE. NWDS ALTITUDE, TAS, AND WINDS MAY BE IN ERROR.
AIU OVERTEMP	AIU TEMPERATURE TOO HIGH	CLEAR MESSAGE. AIU MAY FAIL. TURN NWDS OFF IF NOT ESSENTIAL FOR MISSION.
AIU POWER SUPPLY	ADVISORY - ANY OF THE THREE AIU POWER SUPPLIES HAVE FAILED. AIU MAY FAIL	CLEAR MESSAGE. AIU MAY FAIL. TURN NWDS OFF IF NOT ESSENTIAL FOR MISSION.
ANALOG DATA	ANALOG DATA INVALID	CLEAR MESSAGE. AN/AJB-7 DATA WILL BE USED ON THE ADI INSTEAD OF INS DATA.
BACKUP NAV MODE	INU NAVIGATION IS DEGRADED, AND NWDS HAS SWITCHED TO DR NAVIGATION MODE	CLEAR MESSAGE. IF ADVISORY CANNOT BE CLEARED, NWDS WEAPON IS NOT AVAILABLE.
BDHI DATA	BDHI DATA MAY BE INVALID	CLEAR MESSAGE. BDHI INDICATIONS MAY BE IN ERROR.
CDU OVERTEMP	CDU OVERTEMPERATURE	CLEAR MESSAGE. TURN OFF NWDS IF NOT ESSENTIAL FOR MISSION.
CI DATA	REAR COCKPIT COURSE INDICATOR INDICATIONS MAY BE INVALID	CLEAR MESSAGE. CI INDICATIONS FOR NWDS COMPUTER APPROACH MAY BE IN ERROR. SELECT BACKUP.
HSI DATA	HSI DATA MAY BE INVALID	CLEAR MESSAGE. HSI INDICATION MAY BE IN ERROR.
INU ATT ONLY	INU IS OUTPUTTING ATTITUDE DATA ONLY	CLEAR MESSAGE. NWDS IS OPERATING IN DR MODE. RESYNCHRONIZE COMPASS. NWDS WEAPON DELIVERY MODES UNAVAILABLE.

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Figure 3-9B

LANDING EMERGENCIES

EMERGENCY LANDING PATTERN

The emergency landing pattern is a pattern to be flown when engine thrust is available and an emergency exists or there is a malfunction which could result in an emergency. The primary objective of the pattern is to land the aircraft safely in the first attempt with least amount of risk. Because of the many variables involved, such as type of emergency, position and altitude in relation to the field, gross weight, fuel remaining, weather, populated areas, runway length, availability of arresting gear, etc., a standard pattern cannot be prescribed. Depending on the circumstances it might be desirable to utilize GCA, make a straight-in approach, enter the pattern from downwind or base leg, or make a 360° overhead pattern. Because of the various circumstances, the pilot's evaluation of all factors and his judgment will determine the type of landing pattern to be flown. However, there are some general guidelines which are applicable regardless of approach selected: Reduce gross weight to minimum practical. Prior to establishing the landing configuration, maintain a minimum maneuvering airspeed of 230 knots (250 knots, single engine). The pattern should be planned to avoid abrupt, steep or hard turns and large or abrupt power changes especially with a flight control malfunction or a hydraulic system failure. Circumstances permitting, a long straight-in final should be planned and the landing configuration established when on final. The air refuel switch should be placed to EXTEND prior to landing to depressurize the fuel tanks. Should the nature of the emergency or other factors dictate establishing the landing configuration prior to final, 230 knots – flaps up, or 200 knots – slats flaps OUT AND DOWN should be maintained until established on final. These airspeeds will provide a margin of safety for maneuvering flight. If the pattern must be entered on downwind, base or from an overhead pattern, the pattern should be expanded, the landing configuration established prior to final, and roll-out on final should be at least 2 – 3 miles out. A normal 2 – 3° glide slope should be flown. For most emergencies, final approach airspeeds are increased and AOA decreased to provide adequate aircraft handling characteristics.

FLAPS SLATS EMERGENCY LOWERING

CAUTION

The emergency slats flaps extension system should be activated only if the utility system fails. If the emergency system is activated with normal utility hydraulic pressure available, there is a high probability of losing utility hydraulic system pressure. With utility system pressure available and a known or suspected slats flaps malfunction, a no-slats flaps landing is recommended.

If normal slats flaps operation fails, slats flaps can be lowered pneumatically by executing the following steps:

1. Airspeed – BELOW 250 KNOTS
2. Slats flaps circuit breaker – PULL
3. Slats flaps emergency extension handle – PULL AFT
   If front cockpit emergency slats flaps lowering fails, retain front cockpit handle in the aft position and utilize rear cockpit emergency slats flaps handle. Asymmetric flap extension may occur when flaps are extended by the emergency method. This will result in a momentary roll which can be countered by normal application of aircraft controls. Leave emergency slats flaps extension handle in the full aft position. Returning handle to its normal position allows compressed air from the slats flaps down side of the actuating cylinders to be vented overboard.
4. Slats flaps position indicators – CHECK
   Slats flaps extension with the emergency extension handle will place the slats out and the flaps down. The flaps will indicate DN as soon as extension starts; however, actual flap extension is a function of air loads and they will not be fully extended above about 230 knots. The slats will not operate automatically and will remain out regardless of airspeed. If the pneumatic system fails, the flaps may retract asymmetrically. This will result in a momentary roll which can be countered by normal application of aircraft controls.

LANDING WITH NO FLAPS/SLATS IN OR OUT

A straight-in approach is recommended. For all abnormal slats flaps configurations, on-speed AOA on final will provide satisfactory control, but noticable buffet will be present. If a no-slats flaps landing is a result of flap switch failure or split flaps on the downwind of an overhead pattern, expand the pattern and fly a minimum of 230 knots on the downwind. The slats will extend automatically in accordance with their AOA schedule if electrical and hydraulic power are available unless the slats override switch is placed to IN. The slats override switch should remain at NORM unless an asymmetric slat condition occurs. Refer to Final Approach Speeds chart, appendix A, for corresponding airspeeds for no-slats flaps approaches.

1. Slats flaps – NORM
   Failure of the flaps to extend may indicate a massive leak in the flaps down line. In this case, continued flight with the slats flaps switch OUT AND DOWN can cause utility hydraulic system failure.
2. Slats override switch – NORM (IN FOR ASYMMETRIC SLATS)
3. Fly on-speed AOA on final (17 units for abnormal slat configuration)

ENGINE FAILURE ON FINAL

At the first indication of engine failure, advance both throttles to maximum thrust rather than trying to determine which engine has failed. Any delay in applying power will result in an excessive sink rate and/or airspeed bleed-off. Accept a continued descent until level-off can be smoothly effected. External store drag is negligible at low airspeed and has little effect on performance. Gross weight dictates the thrust required to continue the approach or go-around. Very little yaw is induced by military thrust on one engine. Afterburner thrust creates a slight yaw which can be controlled with rudder. Normally the approach can be continued to a single-engine landing.

1. **THROTTLES - AFTERBURNER**
2. Go around or follow Single-Engine Landing procedure, this section.

NOTE

If the left engine fails and the bus tie remains open, afterburner ignition will not be available. If afterburner thrust is required, afterburner light-offs are generally obtainable through turbine torching by jam accelerating the right engine at 90% rpm or above.

ENGINE FIRE/OVERHEAT ON FINAL

1. Land as soon as possible

If time permits -

2. Throttle good engine - AS REQUIRED
3. Throttle bad engine - IDLE
4. If warning light goes out, fire test button - PRESS
   All FIRE and OVERHT lights should come on. After TO 1F-4-1484 and TO 1F-4-1503, the voice warning FIRE-FIRE should also be heard. If any FIRE/OVERHT light does not come on, assume a burn-through condition in the corresponding engine/aft fuselage. After TO 1F-4-1503, if a burn-through has occurred, the MASTER CAUTION light and telelight panel fault light (FIRE SYS) will come on.

If warning light on, detection system inoperative, or fire confirmed -

5. Generator bad engine - OFF
6. Throttle bad engine - OFF
7. Master switch bad engine - OFF
8. Follow Single Engine Landing procedure, this section.

SINGLE-ENGINE LANDING

1. Reduce the airplane gross weight to minimum practical.
2. Inlet ramp on good engine - CHECK FULLY RETRACTED.
   If inlet ramp is in the extended position, the afterburner must be utilized to make a safe approach.
3. All unessential electrical equipment - OFF
4. Make a fully configured 17 unit AOA approach.

WARNING

- If the utility system on the operating engine fails, the flaps will retract to a low drag trail position. Refer to Utility Hydraulic and Engine Failure (With or Without Single PC Failure).
- If power control system fails on the operating engine, refer to Double Power Control System Failure.

NOTE

- If the left engine is shut down, and the bus tie is open, afterburner ignition on the right engine is not available. However, if afterburner thrust on the right engine is required, afterburner light-offs are generally obtainable through turbine touching by jam accelerating the right engine at 90% rpm or above.
- Utility hydraulic pressure may go to zero for 10 - 15 seconds during landing gear extension with an engine shutdown. Aircraft handling difficulties may be encountered if in other than wings level flight. Delay selection of slats flaps out and down until pressure recovers.
- As the rpm on a windmilling engine decreases, hydraulic pressure may drop below 1500 psi. Anticipate a master caution and CHK HYD telelight if not previously illuminated. As the rpm continues to decrease, loss of associated power control unit and utility pump for the affected engine is imminent.

SINGLE ENGINE GO-AROUND

At the first indication that a go-around may be necessary, advance the throttle of operating engine to maximum thrust. Continue the approach until sufficient airspeed to level off is attained. Begin a shallow angle climb and retract the landing gear. Do not retract the slats flaps below 230 knots.

SPLIT-FLAP/DEFLECTED RUDDER

An unusual roll occurring when the flaps are extended may be due to a split-flap condition. A similar yaw/roll will occur when the flaps are extended if the ARI signal excitation circuit breaker (E9, No. 2 panel) is popped or a fuse in the ARI amplifier is blown. In this case, when the flaps reach the down position the rudder will deflect 10°. The rudder deflection can be overcome by rudder pedal pressure or alleviated by depressing the emergency quick release lever, retracting the flaps or resetting the ARI signal excitation circuit breaker, if popped. When a

split-flap condition or rudder deflection occurs or is suspected:

1. Emergency quick release lever – HOLD PRESSED
2. Immediately accelerate above 200 knots.
3. Slats flaps – NORM
   Retract slats flaps while maintaining positive aircraft control.
4. Emergency quick release lever – RELEASE (After flaps up)
5. ARI signal excitation circuit breaker – RESET (E9, No. 2 panel)
6. Follow No-Slats Flaps Landing procedure.
7. AFCS – DO NOT ENGAGE

CAUTION

After touchdown, use of excessive back stick to provide aerodynamic braking can result in dragging the stabilator due to increased stabilator effectiveness at the higher touchdown speed.

FLAP FAILURE

Inadvertent flap retraction caused by an electrical or hydraulic malfunction, when ar normal approach AOA and with slats flaps OUT AND DOWN selected, can be expected to result in the following:

a. Immediate wing rocking due to asymmeteric flap retraction.
b. An immediate increase of 2 units AOA and lighter stick forces with a nose pitch up movement.
c. Mild buffet within two seconds, increasing with time.
d. Poor directional stability.
e. Increase of sink rate to about 2,000 fpm.

For the above condition, afterburner should be selected in order to ensure aircraft control. Flap failures at lesser AOA do not result in as sudden or significant a change in flight characteristics and should be easily controlled.

LANDING WITH RAMP FAILURE

If both engines are operating, slats flaps OUT AND DOWN landings can be safely made with one inlet ramp fully extended. Reduce gross weight prior to landing. Normal thrust settings must be increased 1 to 2% rpm to maintain an on-speed approach. Afterburner may be required for a late go-around.

Both ramps extended –

1. Make a fully configured 17 unit AOA approach

LANDING WITH EXHAUST NOZZLE FAILURE

If one or both nozzles fail fully closed, consideration should be given to reducing gross weight to the minimum practical. If one nozzle fails fully closed, consider shutting down the affected engine upon landing due to increased thrust at idle power. If both nozzles fail fully closed, the right engine should be shut down on landing to keep critical items on line in case of BUS TIE OPEN. If only one nozzle fails to the open position, make a normal approach and landing. In the event both nozzles fail to the open position, the thrust available in MIL range will be approximately equal to the thrust available during single engine operation in MIL range and a fully configured 17 unit AOA approach should be made.

1. Reduce the airplane gross weight to minimum practical.
2. Shut down affected engine upon landing.

If both nozzles failed open -

3. Make a 17 unit AOA approach.

If both nozzles failed closed -

3. Shut down right engine upon landing.

LANDING WITH BOTH ENGINES INOPERATIVE

Landing with both engines inoperative will not be attempted unless escape from the aircraft is impossible.

LANDING WITH A BLOWN TIRE

The situation may occur when a landing with a blown tire must be made, or a tire may rupture during the landing ground roll or during a touch and go landing. If a rupture occurs during a touch and go, the procedures for Blown Tire During Takeoff will apply. A blown tire and high speed require immediate corrective action to keep the aircraft aligned with the runway, therefore:

LANDING WITH A KNOWN BLOWN TIRE

1. Anti-skid switch – OFF
   Turn the anti-skid switch OFF to prevent loss of braking on the good tire resulting from skid indications from the blown tire.

2. Plan to make an approach-end arrestment.
   Refer to Approach-End Arrestment Procedure, this section.

If an approach-end arrestment is not feasible-

3. Land on side of runway opposite blown tire.
4. Touchdown with weight on good tire.
5. Nose gear steering - ENGAGE
   Even a momentary release of nose gear steering may cause loss of control. Full forward stick will increase nose wheel traction and improve steering capability. If required, use aerodynamic steering and braking on the good tire to maintain directional control.
6. Drag chute - DEPLOY
7. Use opposite braking to stop.

CAUTION

Avoid braking on the wheel with the blown tire. Heavy braking could cause a flat spot on the wheel which could prevent further wheel rotation and make aircraft control more difficult.

8. Do not retract flaps.
   The wing flap seals may have been damaged by piece of broken tire and retracting the wing flaps will increase the damage.

BLOWN TIRE DURING LANDING ROLLOUT

1. **NOSE GEAR STEERING - ENGAGE**
   Even a momentary release of nose gear steering may cause loss of control. Full forward stick will increase nosewheel traction and improve steering capability. If required, use aerodynamic steering and braking on the good tire to maintain directional control.
2. **ANTI-SKID - OFF**
3. **HOOK - DOWN**
4. Use opposite braking to stop.

CAUTION

- Avoid braking on the wheel with the blown tire. Heavy braking could cause a flat spot on the wheel which could prevent further wheel rotation and make aircraft control more difficult.
- If both main tires fail, directional control difficulties may not be apparent until the latter part of the landing roll.

5. Do not retract flaps.
   The wing flap seals may have been damaged by pieces of broken tire and retracting the wing flaps will increase damage.

LANDING WITH ANTI-SKID FAILURE

Landing with a known anti-skid failure requires no special technique except that braking during landing roll must be done with extreme caution to avoid skidding a tire. At high speed and particularly with wet or icy conditions, a wheel can be locked with light pedal pressure and very small pedal deflection. Apply very light pedal pressure initially and slowly increase pedal pressure as speed decreases. If a skid occurs or is suspected, fully relieve brake pressure momentarily to allow the locked wheel(s) to come back up to speed. Plan on using all the runway.

Differential braking cannot correct for swerving or fishtailing due to wheel skid. The aircraft tends to swerve away from the locked wheel requiring release of the brake you would instinctively apply.

An approach-end arrestment should be considered in light of existing environmental factors such as runway condition, crosswind, and arrestment cable location. If the ANTI-SKID INOPERATIVE light illuminates:

1. ARI circuit breaker (Left Subpanel) and anti-skid circuit breakers (A11, B10, B11, No. 3 panel) - CHECK IN
2. Anti-skid switch - CYCLE

If anti-skid is still inoperative -

3. Anti-skid switch - OFF
4. Consider approach-end arrestment. Refer to Approach-End Arrestment, this section
5. Avoid heavy braking

LANDING FROM THE REAR COCKPIT WITH PILOT DISABLED

If the combination of weather, landing facilities, aircrew experience and aircraft condition is less than ideal, consideration should be given to a controlled ejection.

A landing made from the rear seat when the pilot is incapacitated presents a number of problems. The problem areas are: slats flaps and gear lowering, directional control, braking, and engine shutdown. The landing gear and slats flaps can be lowered by the emergency method (blown down) from the aft cockpit. Assuming normal utility pressure, there is a possibility of rupturing the utility hydraulic reservoir when the gear and slats flaps are blown down. However, tests have shown that the probability of the reservoir rupturing when the gear is lowered is fairly remote. These same tests have shown the probability of the reservoir rupturing when the slats flaps are lowered is almost certain. Therefore, it would be advisable to land with flaps up, if practical. If the slats flaps are blown down, the resultant rupture of the utility hydraulic reservoir will make a landing without nosewheel steering or normal brakes necessary. Anti-skid

GEAR INDICATOR OK

If two or more gear up or partially extended –

5. Use Landing Gear Emergency Lowering procedure

If one gear still in wheelwell –

5. Landing gear handle – UP
6. Apply negative G
7. While under negative G, landing gear handle – DOWN
8. If gear still in wheelwell, refer to Landings Gear Malfunctions – Emergency Landings chart.

If one gear still partially extended –

5. Yaw aircraft and apply positive G.
6. If gear still partially extended, refer to Landing Gear Malfunctions – Emergency Landings chart.

LANDING GEAR EMERGENCY LOWERING (UTILITY HYDRAULIC OR ELECTRICAL SYSTEM FAILED)

CAUTION

- Do not use this procedure if the landing gear is already down and locked and subsequent electrical or hydraulic failure occurs. In this circumstance, emergency gear lowering does not make the gear safer and, rarely, has caused a previously down and locked gear to become unsafe.
- If the landing gear is inadvertently extended in flight by emergency pneumatic pressure, they must be left in the extended position until post–flight servicing. If retraction in flight is attempted, rupture of the utility reservoir will probably occur with subsequent loss of the utility hydraulic system.

If normal landing gear operation fails, the landing gear can be lowered by the following procedures:

1. Landing gear circuit breaker – PULL
2. Landing gear handle – DOWN
3. Landing gear handle – HOLD FULL AFT
   Hold handle in full aft position until gear indicates down and locked, and then leave the landing gear handle in the full aft position. It is possible to actuate the landing gear emergency system by pulling the landing gear control handle aft while the handle is in any position from UP through DOWN. If the handle cannot be pulled aft while in the down position, slowly raise the handle while continuing to pull aft. Once the handle moves aft, hold the handle in the full aft position until the landing gear indicates down and locked; then continue to hold back pressure on the handle and return it to the full down position.

WARNING

All normal jettison circuits in the aircraft are disabled once the emergency landing gear control handle in the rear cockpit is pulled. Jettison may still be accomplished by holding the armament safety override button in while actuating the appropriate jettison switch.

If landing gear is still unsafe –

4. Front cockpit gear handle extended, pull rear cockpit gear handle.
5. Yaw aircraft to assist in locking main gear.
6. Bounce aircraft on main gear (during touch and go) to assist lowering/locking the nose gear.
   Due to increased stabilator effectiveness, a no–flap touch and go is recommended.

WARNING

AOA is approximately 1 unit higher than indicated during nose gear up approaches.

7. If gear still unsafe, refer to Landing Gear Malfunctions–Emergency Landings chart.

LANDING GEAR EMERGENCY RETRACTION

If the gear must be retracted after Landing Gear Emergency Lowering, use this procedure. If utility hydraulic system pressure is low, the gear may not retract or may only partially retract.

1. Emergency gear handle(s) – PUSH IN

NOTE

The rear cockpit spring–loaded locking plunger must be pushed UP before the rear handle can be reset.

2. Wait as long as practical (minimum 1 minute)
3. Landing gear handle – UP
4. Landing gear circuit breaker – RESET

CAUTION

The landing gear circuit breaker must not be reset until the emergency handle(s) is/are returned to normal, maintained in that position for a minimum of 1 minute, and then landing gear handle placed UP. Only then may the circuit breaker be safely reset.

LANDING GEAR MALFUNCTIONS-EMERGENCY LANDINGS

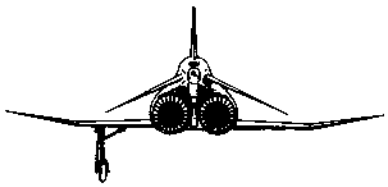
BEFORE ATTEMPTING LANDING, CONSIDER: ARRESTING GEAR LIMITATIONS
CROSSWIND
RUNWAY AND OVERRUN CONDITION
AIRCRAFT CONFIGURATION
AIRCREW EXPERIENCE
TREAT UNSAFE GEAR AS RETRACTED

IF CONDITIONS NOT IDEAL – **EJECT**

BEFORE LANDING-

1. JETTISON ARMAMENT (CONSIDER RETAINING RACKS) - REFER TO JETTISON CHART
2. DUMP OR BURN EXCESS FUEL
3. RETAIN EMPTY EXTERNAL WING TANKS (DEPRESSURIZE)
4. JETTISON ℄ TANK - REFER TO JETTISON CHART
5. SHOULDER HARNESS - LOCK
6. SLATS FLAPS - OUT AND DOWN
7. FLY COMPUTED ON SPEED +10 KNOTS WITH FLAT APPROACH

LANDING NOT RECOMMENDED



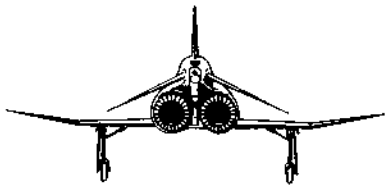
ONE MAIN–NO NOSE

- ATTEMPT TO RETRACT GEAR (NORMAL OR EMERGENCY) & REFER TO ALL GEAR UP

IF GEAR WILL NOT RETRACT–
- GEAR - BLOW DOWN

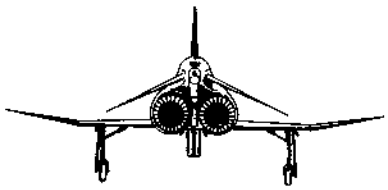
IF STILL ONE MAIN – NO NOSE –
- **RECOMMEND EJECT**

ARRESTMENT NOT RECOMMENDED



BOTH MAIN–NO NOSE

- REQUEST REMOVAL OF APPROACH–END/ MIDFIELD ARRESTING GEAR CABLES
- LAND BEYOND APPROACH–END ARRESTING GEAR (IF INSTALLED).
- AOA INDICATES 1 UNIT LOW
- DO NOT SHUT DOWN ENGINES UNTIL STOPPED
- DEPLOY CHUTE AFTER NOSE LOWERED



BOTH MAIN–STUB NOSE

IF UTILITY HYDRAULIC PRESSURE NORMAL –
- RETRACT GEAR AND REFER TO ALL GEAR UP

IF GEAR IS NOT RETRACTED –
- REQUEST REMOVAL OF APPROACH–END/ MIDFIELD ARRESTING GEAR CABLES
- LAND BEYOND APPROACH–END ARRESTING GEAR (IF INSTALLED)
- DO NOT SHUT DOWN ENGINES UNTIL STOPPED
- DEPLAY CHUTE AFTER NOSE LOWERED

ALL GEAR UP

WITH OR WITHOUT WING PYLONS

WITHOUT EXTERNAL WING TANKS

- DEPLOY CHUTE AT TOUCHDOWN

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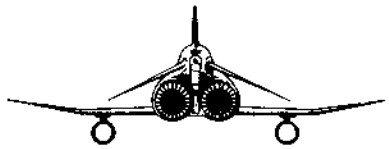
Figure 3-11 (Sheet 1 of 2)

LANDING GEAR MALFUNCTIONS-EMERGENCY LANDINGS

APPROACH END ARRESTMENT RECOMMENDED

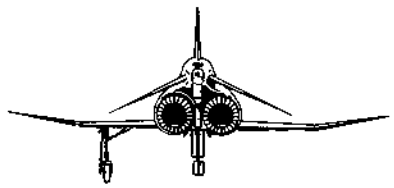


ALL GEAR UP

WITH EXTERNAL WING TANKS

- DEPLOY CHUTE AT TOUCHDOWN

IF ARRESTMENT NOT PRACTICAL –
- DEPLOY CHUTE AT TOUCHDOWN

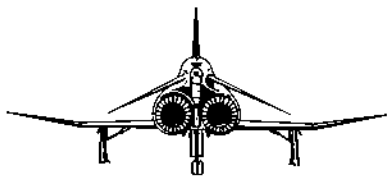


ONE MAIN NOSE DOWN

IF UTILITY HYDRAULIC PRESSURE NORMAL –
- RETRACT GEAR AND REFER TO ALL GEAR UP

IF GEAR IS NOT RETRACTED –
- DO NOT DEPLOY CHUTE (EXCEPT MISSED ENGAGEMENT)

IF ARRESTMENT NOT PRACTICAL–
- LAND OFF RUNWAY ℄ OPPOSITE FAILED GEAR
- DEPLOY CHUTE AT TOUCHDOWN
- DO NOT SHUT DOWN ENGINES UNTIL STOPPED

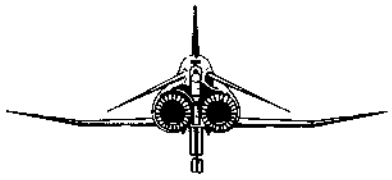


STUB MAIN OR BOTH STUB MAIN–NOSE DOWN

IF UTILITY HYDRAULIC PRESSURE NORMAL–
- RETRACT GEAR AND REFER TO ALL GEAR UP

IF GEAR IS NOT RETRACTED –
- LAND OFF RUNWAY ℄ OPPOSITE FAILED GEAR
- DO NOT DEPLOY CHUTE (EXCEPT MISSED ENGAGEMENT)

IF ARRESTMENT NOT PRACTICAL–
- LAND OFF RUNWAY ℄ OPPOSITE FAILED GEAR
- DEPLOY CHUTE AT TOUCHDOWN
- DO NOT SHUT DOWN ENGINES UNTIL STOPPED



NO MAIN – NOSE DOWN

- DEPLOY CHUTE AT TOUCHDOWN

IF ARRESTMENT NOT PRACTICAL–
- DEPLOY CHUTE AT TOUCHDOWN
- DO NOT SHUT DOWN ENGINES UNTIL STOPPED

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Figure 3-11 (Sheet 2 of 2)

5. Refer to Landing Gear Malfunctions-Emergency Landings chart.

AUXILIARY AIR DOOR MALFUNCTION (GEAR DOWN)

If the auxiliary air doors fail to open when the landing gear is lowered, there is a possibility that the engines may automatically accelerate up to 100% rpm. A utility hydraulic system failure or double generator failure will render the variable bypass bellmouth and auxiliary air doors inoperative. Operation of an engine with an open variable bypass bellmouth and closed auxiliary air door will allow engine compartment secondary air to recirculate to the engine compressor inlet. During low altitude or ground operation, the temperature of the recirculating air may be high enough to initiate T2 reset through normal detection by the compressor inlet temperature sensor. As T2 reset occurs, it increases the engine idle speed to maintain proper airflow and thrust under high temperature conditions, and can cause the idle speed to increase to 100% rpm. The auto–accelerated engine can be shut down by placing the throttle to OFF. If a false reset occurs while airborne, a near normal landing can be made by modulating the exhaust nozzles of the affected engine(s).

1. Auxiliary air door control circuit breakers – RESET (A2, A3, No. 3 panel)

If light(s) remain on –

AUTO–ACCELERATION OF ONE ENGINE

1. Throttle bad engine – IDLE
   Modulate throttle of good engine for desired thrust. The combined thrust of the auto–accelerated engine in idle, and the good engine in idle, will not be in excess of that required to make an optimum on speed approach.
2. At touchdown, bad engine – SHUTDOWN

AUTO–ACCELERATION OF BOTH ENGINES

1. Throttle of either engine – IDLE
2. Modulate throttle of remaining engine for desired thrust.
3. Make a fully configured 17 unit AOA approach
4. Make an approach–end arrestment.
   Refer to approach–end arrestment procedure, this section.
5. At touchdown, right engine – SHUTDOWN

ARRESTING HOOK EMERGENCY OPERATION

If the arresting hook fails to extend when the control handle is placed in the down position, deenergize the solenoid selector valve by pulling the hook control circuit breaker in the rear cockpit. Pressure is then removed from the up side of the arresting hook actuator cylinder and the hook will extend. There are no provisions for arresting hook retraction in the event of a utility hydraulic failure or double generator failure.

1. Hook handle – DOWN
2. Arresting hook circuit breaker – PULL (A4, No. 3 panel)

APPROACH–END ARRESTMENT

Approach–end arrestments are considered practical whenever a malfunction or adverse weather conditions present a threat to directional control and there is suitable landing surface in front of the arrestment cable on which to land and lower the nose prior to cable contact. A touchdown point should be selected based on existing environmental factors such as arrestment cable location, runway condition, crosswind, nature of emergency and anticipated difficulty in high speed directional control. Consideration should also be given to the engaging speed limits to prevent structural failure to the arresting gear or the aircraft. See Field Arresting Gear Data (figure 3–14).

1. Notify tower.
2. Reduce gross weight to lowest practical.
3. Fly pattern as dictated by emergency.
4. Gear – DOWN
5. Hook – DOWN
6. **Air refuel switch - EXTEND (monitor fuel gage)**
7. Inertia reel – LOCKED
8. Plan for missed engagement
   Consider type of emergency, availability of back-up barriers, runway length, runway condition, fuel state, weather, and other pertinent factors.
9. Fly final approach to touchdown a minimum 300 feet short of cable.

WARNING

When directional control difficulties are anticipated, a landing should be planned as close to the cable as practical; however, no closer than 300 feet.

10. Throttles – IDLE
11. Stick – FORWARD

AIRSPEED INDICATOR FAILURE

1. Pitot heat – ON
2. Pitot heat circuit breaker - CHECK IN (D9, No. 3 panel)

FLIGHT CONDITION		ANGLE-OF-ATTACK UNITS
MILITARY POWER CLIMB		
Drag Index = 0	Sea level	5.0
	combat ceiling	9.5
Drag Index = 120	Sea level	8.5
	combat ceiling	10.0
MAXIMUM POWER CLIMB		
All Drag Indexes	Sea level	4.5
	combat ceiling	11.5
CRUISE AT ALTITUDES BELOW 20,000 FT. (all gross weights)		
Drag Index = 0		7.0
Drag Index = 130		8.5
CRUISE AT OPTIMUM ALTITUDE		
Drag Index = 0		8.5
Drag Index = 130		9.0
ENDURANCE AT OPTIMUM ALTITUDE		
Drag Index = 0		9.5
Drag Index = 130		14.0
DESCENTS (low to medium gross weight)		
250 KNOTS, idle power		9.0
300 KNOTS, 80% rpm.		7.0
APPROACH		
GCA Pattern (250 knots, gear up, slats flaps up)		9.0
Gear extension (250 knots)		9.0
Slats flaps extension (gear down, 200 knots).		11.5
Final "On Speed" approach (slats flaps any position, gear down)		19.2
STALL		
Stall warning (pedal shaker)		22.3

Notes

- DUE TO THE BASIC DIFFICULTY OF SETTING UP FLIGHT CONDITIONS (OTHER THAN LANDING APPROACH) BY REFERENCE TO THE ANGLE OF ATTACK INDICATOR, THE INFORMATION INCLUDED IN THIS TABLE SHOULD BE USED ONLY IN AN EMERGENCY SITUATION.
- THE RANGES SHOWN FOR ANGLE OF ATTACK VERSUS DRAG INDEX, WHILE NOT ENTIRELY LINEAR, MAY BE INTERPOLATED LINERALLY FOR PRACTICAL PURPOSES.
- THE FLAP EXTENSION AND RETRACTION AIRSPEEDS ARE SENSED FROM THE PITOT STATIC SYSTEM.
- DURING LANDING APPROACH, WITH UNRELIABLE AIRSPEED INDICATIONS ABOVE THE 210-250 RANGE, THE FLAPS MAY NOT EXTEND AND THE RUDDERS MAY REMAIN IN THE HIGH GRADIENT LEVEL.

WARNING

DURING LANDING APPROACH WITH FLAPS SELECTED AND INDICATED AIRSPEED FLUCTUATIONS ABOVE AND BELOW THE 210-244 RANGE, THE FLAPS MAY EXTEND OR RETRACT WITHOUT WARNING.

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Figure 3–13

FIELD ARRESTMENT GEAR DATA

AIRCRAFT WEIGHT – POUNDS	BAK – 6	BAK – 9	BAK – 12/14 STD	BAK – 12/14 1200′ R.O.	DUAL BAK – 12 / BAK – 13	M – 21	MA – 1/1A (MA – 1A Mod)	E – 28	MAAS *
	MAXIMUM ENGAGEMENT SPEED – KNOTS GROUND SPEED								
30,000	160	172	180	180	180	140	92	180	170
32,000	160	170	180	180	180	140	90	180	170
34,000	160	168	180	180	180	140	88	180	170
36,000	158	166	180	180	180	140	86	180	170
38,000	156	164	180	180	180	140	84	180	170
40,000	154	162	180	180	180	140	82	180	170
42,000	153	158	180	180	180	140	81	180	
44,000	152	155	178	180	180	135		177	
46,000	150	150	176	180	180	135		177	
48,000	148	146	174	180	180	135		177	
50,000	146	142	170	180	180	135		177	
52,000	145	140	168	179	180	135		177	
54,000		135	166	178	180	135		177	
56,000		134	163	177	180	125		176	
58,000		132	161	176	180	125		176	
60,000		130	159	175	180	125			

* Mobile Aircraft Arresting System

NOTE

■ DO NOT DELAY A REQUEST FOR ARRESTING GEAR, RAISING A BAK–12 DEVICE CAN REQUIRE 7 1/2 SECONDS BEFORE IT IS FULLY UP AND LOCKED. WITH A 3 SECOND OPERATOR REACTION TIME, THE AIRCRAFT WILL TRAVEL 2200 FEET AT 125 KNOTS BEFORE THE GEAR IS FULLY UP AND LOCKED.

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Figure 3-14

WARNING / INDICATOR LIGHTS

LIGHT	CAUSE	CORRECTIVE ACTION/REMARKS
AFCS ALT/GP DISENGAGED	ALTITUDE HOLD OR AUTOMATIC GLIDE PATH STEERING DISENGAGED	INFO ONLY
ALT ENCODER OUT	UNRELIABLE OR NO SIGNAL FROM ALT ENCODER	IF LIGHT STAYS ON: USE VOICE COMMUNICATIONS IF LIGHT FLASHES CONTINUOUSLY: PULL AEU CB (H8, H9, NO. 2 PANEL)
R OR L ANTI-ICE ON	NORMAL IF SWITCH IS ON	IF SWITCH OFF - REDUCE AIRSPEED • IF LIGHT GOES OUT - ACCELERATE AND DISREGARD LIGHT • IF LIGHT STAYS ON - REMAIN AT REDUCED SPEED
ANTI-SKID INOPERATIVE	ANTI-SKID HAS MALFUNCTIONED	• CARRY OUT EMERGENCY PROCEDURE • DISREGARD MOMENTARY LIGHT
APU	PC-1 PRESS BELOW 1000 PSI	• CARRY OUT PC FAILURE PROCEDURE IF NEITHER PC HAS FAILED- • APU CONTROL CB (F5, NO. 1 PANEL)-PULL • LAND AS SOON AS PRACTICAL
AUTOPILOT DISENGAGE	AUTOPILOT IS NOT ENGAGED	INFO ONLY
AUTOPILOT PITCH TRIM	AUTOPILOT ENGAGED AND AUTOPILOT PITCH TRIM IS MALFUNCTIONING	• STICK - GRASP FIRMLY • AUTOPILOT - DISENGAGE
R OR L AUX AIR DOOR	DOOR(S) OUT OF PHASE WITH GEAR HANDLE.	CARRY OUT EMERGENCY PROCEDURES
BUS TIE OPEN	GEN ARE OUT OF FREQUENCY PHASE, OR FAULTED CSD UNDERSPEED SWITCH	CARRY OUT EMERGENCY PROCEDURE
CABIN TURB OVERSPEED	TURBINE PRESSURE/TEMP TOO HIGH	• REDUCE THRUST AND SPEED • IF LIGHT STAYS ON: EMER VENT KNOB - PULL
CANOPY UNLOCKED	CANOPY UNLOCKED	GROUND: • REFER TO CANOPY MALFUNCTION PROCEDURE INFLIGHT: • COCKPIT PRESS-DUMP • REDUCE POWER AND AIRSPEED • COMMAND SELECTOR VALVE - VERTICAL IF REAR CANOPY UNSAFE • CANOPY HANDLE - DO NOT MOVE
CHECK FUEL FILTERS	FUEL FILTER(S) ARE CLOGGED	NOTE IN FORM 781
CHK HYD GAGES	PRESSURE BELOW 1500 ± 100 PSI IN PC-1, PC-2 SYS OR UTILITY SYS	CARRY OUT EMERGENCY PROCEDURES
DC BUS	MAIN 28VDC BUS DISCONNECTED FROM ESS 28VDC BUS BECAUSE OF LOW VOLTAGE ON 28VDC	CARRY OUT EMERGENCY PROCEDURE
DUCT TEMP HI	INLET TEMP ABOVE 121°C	• REDUCE SPEED • MAINTAIN SUBSONIC CRUISE
L EXT FUEL CTR EXT FUEL R EXT FUEL	• TANK EMPTY • FLOW STOPPED • AIR REFUEL-EXTEND AND REFUEL SELECTION-ALL TANKS	INTERMITTENT ILLUMINATION DURING TRANSFER IS NORMAL
FIRE OVERHT	EXCESSIVE TEMPERATURES IN ENGINE OF AFT COMPARTMENT	CARRY OUT EMERGENCY PROCEDURES
FIRE SYS	BURN-THROUGH OR DETECTION SYSTEM FAULT	CARRY OUT EMERGENCY PROCEDURES
FUEL LEVEL LOW	FUEL REMAINING: 1800 ± 200 POUNDS BLK 41 AND UP: 1650 ± 200 POUNDS	CHECK ALL FUEL TRANSFERRED, FEED TK CHK AND FUEL LOW WARN CB (H4, NO. 2 PANEL) IN, ESSENTIAL DC PWR AVAILABLE. IF ANY TANK TRANSFER CB POPPED, REFER TO FUSELAGE FUEL FAILS TO TRANSFER

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Figure 3-15 (Sheet 1 of 2)

WARNING / INDICATOR LIGHTS

CONTINUED

LIGHT	CAUSE	CORRECTIVE ACTION/REMARKS
FUEL INDICATOR ERR LEGEND FLASHING	FUEL QUANTITY SYSTEM MALFUNCTION	ID CODE C, NO CORRECTIVE ACTION. COMPENSATOR FAULT ID CODES 1, 26 AND 00. COMPARE SECTOR AND COUNTER FOR FUEL LOCATION. CHECK FUEL LEVEL LOW LIGHT. RECORD ALL CODES IN AF FORM 781.
LH GEN OUT RH GEN OUT	GEN OFF THE LINE	CARRY OUT EMERGENCY PROCEDURE
HOOK DOWN	HOOK IS UNLOCKED	INFO ONLY
IFF	STEADY-MODE 4 ZEROIZED BLINKING - MODE 4 NOT RESPONDING TO INTERROGATION	STEADY - INFORMATION BLINKING - CHECK MODE 4 SELECTOR ON
IMU OUT	IMU FAILURE OR MALFUNCTION	REFERENCE SELECTOR - STBY
INERTIAL NAV SYS OUT	INS MALFUNCTION (NON NWDS) INU, AIU, ACU FAULT (NWDS)	REFERENCE SYSTEM SELECTOR - STBY CARRY OUT EMERGENCY PROCEDURES (NWDS)
MASTER CAUTION	CAUTION CONDITION EXISTS	CHECK TELEFLIGHTS
NAV MODE STATUS	DMS HAS AUTOMATICALLY DEGRADED OR UPGRADED NAVIGATION MODE	SELECT NCSC MODE CORRESPONDING TO ILLUMINATED NCSC STATUS LIGHT. CHECK PRESENT POSITION TO ENSURE LORAN DID NOT DISTORT PRESENT POSITION.
OXYGEN LOW	QUANTITY IS 1 LITER OR LESS	DESCEND TO SAFE ALTITUDE
PITCH AUG OFF	PITCH STAB AUG NOT ENGAGED	DO NOT EXCEED 300 KNOTS BELOW 10,000 FEET
RADAR CNI COOL OFF	EQUIPMENT COOLING TURBINE OFF	CARRY OUT EMERGENCY PROCEDURE
SLATS IN	SLAT OVERRIDE SWITCH AT IN POSITION	INFO ONLY
SPEEDBRAKE OUT	SPEEDBRAKES NOT CLOSED	INFO ONLY
STATIC CORR OFF	SPC INOPERATIVE	• CADC SWITCH - RESET CORR. IF LIGHT STAYS ON: • CADC SWITCH - CORR OFF • USE ALTITUDE LAG CHART
TANK 7 FUEL	LIGHT INOPERATIVE	LIGHTS ON TEST ONLY
WHEELS	BELOW APPROXIMATELY 230K-GEARUP	LOWER GEAR OR ACCELERATE ABOVE FLAP BLOW-UP SPEED
WINDSHIELD TEMP HIGH	• WINDSHIELD OVERHEATED ILLUMINATED NORMAL AND NO ACTION ACQUIRED WITH (1) BUS TIE OPEN-RIGHT GEN OUT (2) INTERMITTENT AT HIGH MACH WITH RAIN REMOVAL OFF	• RAIN REMOVE SWITCH-OFF IF LIGHT STAYS ON • EMERGENCY VENT KNOB-PULL • DESCENT BELOW 25,000 FEET

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Figure 3-15 (Sheet 2 of 2)

SECTION IV
AUXILIARY EQUIPMENT

TABLE OF CONTENTS

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Navigation and Weapon Delivery System AN/ASQ-203 (After TO 1F-4E-671) .. 4-19
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Miscellaneous Equipment 4-21

The following systems are not described in this manual but are listed for reference purposes together with the reference letter for the manual which contains the detailed description and operational application as follows:

A TO 1F-4E-34-1-1
B TO 1F-4E-34-1-1-1
C TO 1F-4E-34-1-1-2
D TO 1F-4E-34-1-1-3
E TO 1F-4C-25
F TO 1F-4C-34-1-2
G TO 1F-4C-34-1-1-2

Navigation and Weapon Delivery System .. D
Digital Modular Avionics System C
Fire Control System ..... A
Radar Recording and Strike Camera Systems ..... A
Multiple Weapons Control System ..... A
Lead Computing Optical Sight ..... A, D
Weapons Release Computer Set AN/ASQ-91 ..... A
Weapon Suspension Equipment ..... A
Special Weapons Delivery Systems ..... E
Nose Gun System M61A1 ..... A
Gun Pods ..... F
Low Altitude Bombing System (LABS) .... A
Tow Target Systems ..... F
Radar Warning Receiver (RWR) ..... B, G
Electronic Countermeasures Pods ..... B
Target Identification System Electro Optical (TISEO) C
Radar X Band Transponder SST-181X .... A
Electro-Optical Target Designator System AN/ASQ-153(V) ..... A
Interrogator Set AN/APX-80A/81 ..... G
AN/ALE-40 Countermeasures Dispensing Set ..... A
Pave Tack Pod AN/AVQ-26 C
Airborne Video Tape Recorder ..... A

AIR CONDITIONING AND PRESSURIZATION SYSTEM

Air conditioning in the aircraft is divided into two major systems, one for cockpit areas and one for electronic equipment cooling. The cockpits for both crewmembers are pressurized and supplied with conditioned air from the cockpit air conditioning system. The same air that pressurizes and heats the cockpit is used to keep the windshield free of fog, frost, rain and to purge the gun gases from the breech of the M61A1 nose gun. The equipment air conditioning system provides cooling air for the main radar package and communication-navigation-identification equipment. Both systems utilize high temperature, high pressure, 17th stage engine compressor bleed air from either or both engines.

AIR CONDITIONING

The cockpit air conditioning system on the right side of the forward fuselage (figure 4-1) consists of two air-to-air heat exchangers, ground ejector, an expansion turbine, pressure regulator and shutoff valve, mixing valves, and a temperature control which allows a selection of cockpit conditioning temperatures, defogging, rain removal, and ram air operations. High temperature, high pressure, engine compressor bleed air passes through the primary and secondary heat exchanger and is expanded (cooled) through the cooling turbine. After being mixed with hot compressor bleed air (as required by the temperature selection) it enters the cockpit through several manifolds, one near the front cockpit rudder pedals, one near the rear cockpit rudder pedals, one along the lower surface of each windshield side panel and one at the base of the flat optical panel of the windshield. Two eyeball type air nozzles are located just below the canopy sill on the right and left side of the rear cockpit.

COCKPIT AIR CONDITIONING

The cockpit air conditioning system operation can best be explained by referring to the cockpit temperature schedule (figure 4–2). The lower temperature range (refer to the curve labeled foot heat) produces temperatures from −29°C to 38°C. These temperatures refer to the inlet air and not cockpit temperature; therefore, cockpit temperature will be determined by a combination of inlet air and environmental conditions. The low temperature curve is the governing schedule for all air entering the cockpit while in automatic temperature control with the defog–foot heat lever in the LOW range. A little air is always entering through the defog port and this air increases (while foot heat air decreases) as the lever is moved forward. Until a switch is made, both defog and foot heat air enter on the low temperature schedule. The switchover to the high temperature curve occurs at

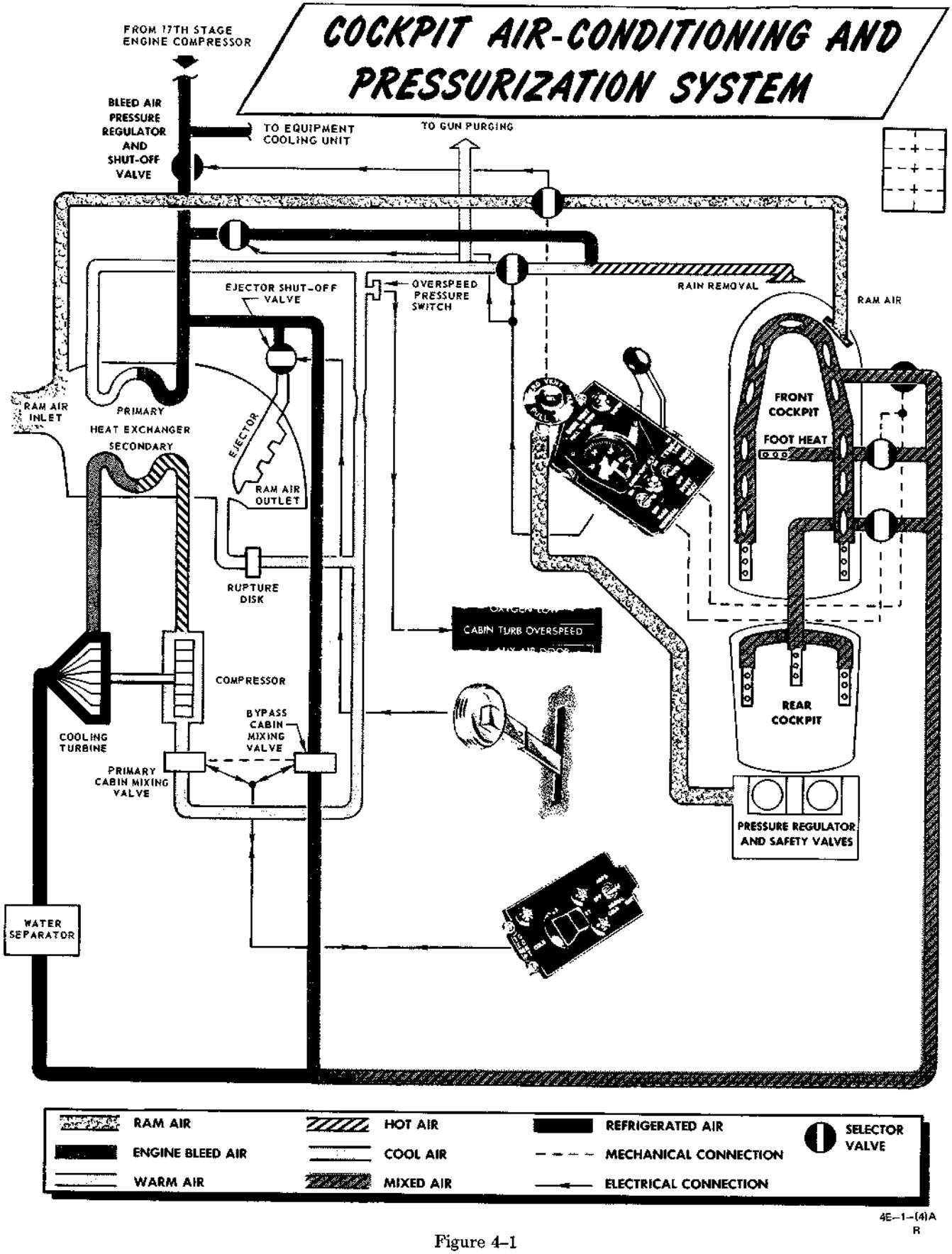

COCKPIT AIR-CONDITIONING AND PRESSURIZATION SYSTEM
FROM 17TH STAGE ENGINE COMPRESSOR
BLEED AIR PRESSURE REGULATOR AND SHUT-OFF VALVE
TO EQUIPMENT COOLING UNIT
TO GUN PURGING
EJECTOR SHUT-OFF VALVE
OVERSPEED PRESSURE SWITCH
RAIN REMOVAL
RAM AIR
RAM AIR INLET
PRIMARY HEAT EXCHANGER
SECONDARY
EJECTOR
RAM AIR OUTLET
FRONT COCKPIT
FOOT HEAT
RUPTURE DISK
CABIN TURB OVERSPEED
COMPRESSOR
BYPASS CABIN MIXING VALVE
COOLING TURBINE
PRIMARY CABIN MIXING VALVE
REAR COCKPIT
PRESSURE REGULATOR AND SAFETY VALVES
WATER SEPARATOR
RAM AIR
ENGINE BLEED AIR
WARM AIR
HOT AIR
COOL AIR
MIXED AIR
REFRIGERATED AIR
MECHANICAL CONNECTION
ELECTRICAL CONNECTION
SELECTOR VALVE
4E-1-(4)A
R

Figure 4–1

WARNING

- Do not attempt to change pitch attitude of the aircraft from the rear cockpit in the AFCS mode. Since no force transducer is in the rear cockpit control stick, applying force will cause pitch trim to run up and down depending on pressure applied. If the pilot attempts to take control at that point, violent transients may be encountered.
- When selecting the AFCS mode, have hand on control stick to counteract any abrupt control movements in the event of an AFCS malfunction.
- Before DMAS, do not have the AFCS engaged when the bombing mode(s) are being used. These modes use the AN/AJB-7 and transients introduced into the attitude input of the AFCS at pull-up could cause pitch and/or roll oscillations.

4. When altitude hold mode is desired, place altitude hold switch to ENGAGE.

On aircraft after TO 1F-4E-626

5. To engage the DMAS controlled computer autopilot steering mode, ensure that the following conditions are met:
   a. Destination data has been inserted in the DMAS for each route destination point (sequential point number thru magnetic variation).
   b. Keyer control STEER knob - AS DESIRED
   c. Navigation function selector panel mode selector knob - COMPTR NAV
   d. Course selector panel CSE SEL switch - AS DESIRED
   e. Course selector panel NAV PIT SEL switch - AS DESIRED
   f. Aircraft ground track is within $\pm 22.5°$ of present destination inbound course.
   g. AFCS switch - ENGAGE
   h. CMPTR STEER switch - ENGAGE
6. To engage the DMAS computer coupled approach mode, ensure that the following conditions are met:
   a. The desired runway touchdown point coordinates and desired approach course have been inserted in the DMAS for the selected L destination.
   b. Keyer control steer display window shows the destination number for the destination selected as the FLY TO point.
   c. Keyer control STEER knob - NAV M or NAV A

NOTE

In the CMPTR APR mode, destination auto sequencing is inhibited.

   d. Course selector panel CSE SEL switch - KYBD
   e. Course selector panel NAV PT SEL switch - AS DESIRED
   f. Establish aircraft within the computer coupled approach capture bounds.
   g. Navigation function selector panel mode selector knob - CMPTR APR.
   h. AFCS switch - ENGAGE (if desired)
   i. AFCS CMPTR STEER switch - ENGAGE (if desired)
   j. AFCS ALT/GP switch - ENGAGE (if desired)

GENERATOR SWITCHING

Power to the autopilot, air data computer, and the AJB-7 may be momentarily interrupted during the starting and stopping of the airplane engines or generators. When the right engine or generator is started with the left generator already on the line, the connection between the right and left main buses is momentarily opened to allow the right generator to come on the line. This momentary interruption of power will cause the autopilot to disengage. The stab aug switches are not solenoid held, and remain on without electrical power. The AFCS, AJB-7 and air data computer are not affected by starting or stopping the left engine or generator with the right generator on the line.

NOTE

If failure of the right generator occurs, disengage the stab aug switches prior to cycling the generator. This prevents the possible occurrence of control surface transients. Stab aug may be re-engaged with the right generator control switch retained OFF or stab aug may be re-engaged after the generator control switch has been returned to the ON position.

OPERATIONAL PRECAUTIONS

Roll Reversal

There is a possibility of a condition called roll reversal occurring when operating the automatic flight control system in the AFCS mode. This condition occurs infrequently and is apparent only when attempting small changes in bank angle. Roll reversal is associated with a small out-of-trim condition in the lateral channel, and is apparent as a slow rolling of the airplane in the opposite direction of the stick force. If, for instance, the airplane is out of trim laterally to the left when the AFCS mode is engaged, roll reversal may occur when right stick forces are applied. A roll reversal situation may be caused by operating the manual lateral trim button while in the AFCS mode, followed by small stick forces being applied opposite to the direction of the trim. There is a possibility of roll reversal occurring even if the airplane has been trimmed prior to engaging the AFCS mode, and the manual trim button has not been touched. This condition is caused by changes in airplane trim accompanying changed flight conditions. In view of the above, the following instructions should be observed:

1. Trim airplane in stability augmentation mode before engaging AFCS mode.
2. Do not operate manual lateral trim while the AFCS mode is engaged. If roll reversal is encountered due to change in flight condition; disengage roll, retrim, then reengage.

Pitch Oscillations

When using the altitude hold mode, the aircraft may experience pitch oscillations in the transonic regions due to fluctuations in the air data computer airspeed system. The nature of these oscillations vary from stick pumping to divergent pitch oscillations. It is recommended that if pitch oscillations occur at transonic speeds, the following corrective steps be attempted:

1. AFCS switch - DISENGAGE
2. Static pressure compensator switch - OFF
3. AFCS switch - ENGAGE
4. Engage altitude hold mode

If the oscillations persist after the above action, or if they are encountered at supersonic speeds:

1. Disengage altitude hold mode.

WARNING

Divergent pitch oscillations should not be allowed to develop. If any divergent pitch activity is noted, corrective action should be taken immediately.

INERTIAL NAVIGATION AND ATTITUDE-HEADING REFERENCE SYSTEM

The system consists of two separate gyro reference components and a navigation computer. The inertial navigation set AN/ASN-63 supplies the primary azimuth and attitude reference, and in addition supplies direction, velocity, and distance inputs to the navigation computer. The INS also supplies aircraft attitude, true heading, velocities, and height above sea level to the Weapons Release Computer Set (WRCS). The AN/AJB-7 is the standby attitude reference and in addition supplies information for LABS and LADD bombing maneuvers. The AN/AJB-7 is also used in conjunction with the WRCS. After TO 1F-4E-626, the inertial navigation set and the weapons release computer set are removed and replaced by the digital modular avionics system (DMAS). The DMAS is described more fully in TO 1F-4E-34-1-1-2. After TO 1F-4E-671, the inertial navigation set and the weapons release computer set are removed and replaced by the Navigation and Weapon Delivery System (NWDS). The NWDS is described more fully in TO 1F-4E-34-1-1-3.

INERTIAL NAVIGATION SET

Before TO 1F-4E-626 and TO 1F-4E-671, the inertial navigation set (INS) is a self-contained, fully automatic unit which uses a gyro stabilized (inertial) platform upon which are mounted three sensitive accelerometers. During alignment, the sensitive axes of the accelerometers are aligned through interaction of the accelerometers and gyros; one is aligned to the north-south axis, one to the east-west axis, and one to the vertical axis. With the platform stabilized in pitch and roll by gyros, and oriented to true north, the accelerometers sense acceleration in any direction. This acceleration is integrated by a computer to produce velocity (ground speed), course, and distance traveled. The AN/ASN-63 contains circuitry to correct for apparent precession, based on the latitude of the INS position. The AN/ASN-63 provides navigation and attitude information to various aircraft systems, and in addition provides output signals to the WRCS, Lead Computing Optical Sight System and Radar.

After TO 1F-4E-626, the INS supplies true heading and vertical acceleration to the fire control ACM computer.

After TO 1F-4E-671, the INU supplies true heading and vertical acceleration to the fire control ACM computer.

Inertial Navigation System Out Lights

The INERTIAL NAV SYS OUT lights, on the front cockpit right subpanel, and on the rear cockpit main instrument panel, illuminate when the INS is in OFF, or a malfunction has occurred. If the set is operating normally, the lights extinguish when the power control knob is placed to the STBY position.

Inertial Navigation Control Panel (Before TO 1F-4E-671)

The inertial navigation control panel provides the controls for operating the inertial navigation set. The controls include a power control knob with positions of OFF, STBY, ALIGN and NAV; and an align mode switch with positions of HDG MEM and GYRO COMP. The mode selector knob controls system operation. The STBY position applies power to bring the inertial platform up to operating temperature as indicated by the illumination of the amber HEAT light. The HEAT light goes out when the unit reaches operating temperature. The ALIGN position is selected for stabilization of the platform and alignment to true north. The sequence of alignment is indicated by the green ALIGN light. The NAV position is selected after the align phase is completed (as noted by the green ALIGN light flashing) and is the normal operating position for the inertial navigation set. The align mode switch determines the method of alignment. The Gyro Comp align is the most accurate means of aligning the system. The HDG MEM

alignment is used for aircraft on alert or under possible scramble situations. Heading information obtained from a previous gyrocompass alignment is maintained in the system after the set is turned off.

ALIGNMENT PROCEDURES

Before TO 1F−4E−671, during the align sequence of the inertial navigation set, the compass system is automatically in the compass mode and the horizontal situation indicator and bearing distance heading indicator compass cards read magnetic heading directly from the flux valve. ADI azimuth information is not usable. If the wings are folded, the flux valve reading is not accurate and a greater magnetic variation is required to realize a variation synchronization on the navigation computer control panel. The reason is that in the wings folded position condition, the flux valve which is in the left wing, is oriented about 60° from its proper position. If the magnetic variation of the local area is not used, gyrocompass alignment takes longer to complete. Before aligning the inertial navigation set, place the navigation computer function selector knob to STBY, the position update switch to NORMAL, the variation counter to the local magnetic variation, and the postion counter to the local latitude and longitude.

After TO 1F−4E−671, for INS alignment procedures on NWDS equipped aircraft refer to TO 1F−4E−34−1−1−3.

Gyrocompass Alignment

The gyrocompass mode of alignment is the most accurate means of alignment, with a 3 nautical miles of error per hour of circular error probability (CEP). However, it requires a longer period of time to accomplish than the other modes. To gyrocompass align the system, place the align mode switch to GYRO COMP and then the power

control knob to STBY. The amber HEAT light then illuminates. The cold start feature of the system enables the gyros to spin during standby and heat the system more evenly, therefore obtaining greater system accuracy. Coarse alignment is accomplished during the heating cycle. The time required for the system to reach operating temperature (160°F) is determined by the ambient temperature. The system warms up at the rate of at least 20°F per minute. When the HEAT light goes out, place the power control knob to ALIGN. There is a heat delay in the computer of 110 seconds after the system reaches operating temperature, and the HEAT light extinguishes after this time delay has elapsed. Gyrocompass alignment cannot be accomplished until the HEAT light has extinguished. If the HEAT light illuminates again during the align phase, continue with the alignment, but make an entry in the AFTO Form 781. Completion of Best Available True Heading Alignment (BATH) is indicated by illumination of the green align light. This light comes on after 75 seconds. When the align light illuminates gyrocompass alignment has commenced. The time for completion of the gyrocompass alignment cycle varies due to the error present after BATH alignment. When the axis of the platform reaches within 10 arc minutes (1/6°) of true north, a flasher circuit delay energizes to ensure the system maintains alignment. The duration of the delay is 50 seconds and the align light does not flash indicating completion of gyrocompass alignment until the delay has elapsed. The system should be left in the ALIGN mode 2 minutes for greater system accuracy. The power control knob is then placed to NAV for system operation and the align light goes out. The heat or align light is not functional in the NAV mode. On aircraft after TO 1F-4E-626, refer to TO 1F-4E-34-1-1-2 for DMAS gyrocompass alingment.

Best Available True Heading Alignment

If operational considerations dictate, the time required to align the INS can be reduced, with a corresponding reduction in INS operational accuracy, by performing a Best Available True Heading (BATH) alignment. A normal Gyrocompass alignment is accomplished up to a steady green ALIGN light. With the ALIGN light on steady, instead of waiting for the light to flash, place the power control knob to NAV. Since the set was not allowed to complete gyrocompass alignment (precise alignment with true north) accuracy of the INS outputs is reduced. The degree of inaccuracy cannot be predicted; however, a 5½ nautical mile per hour circular error probability can normally be expected, but greater inaccuracies are not uncommon.

NOTE

A BATH alignment should not be used when the aircraft is in a hangar, near any large metal objects (power carts, etc.), or when the wings are not spread and locked. Gyrocompass alignment should be used whenever the aircraft magnetic heading signal is unreliable.

Heading Memory Alignment

Heading memory alignment is used when minimum alignment time is required and provides a 5½ nautical mile per hour circular error probability. Prior to heading memory alignment, a gyrocompass alignment must have been performed through the flashing of the ALIGN light indicating that the system is aligned. The power control knob must be left in ALIGN until after placing the align mode switch to HDG MEM. The power control knob is then placed to OFF or STBY. From this time until the completion of the heading memory alignment, the aircraft must not be moved. When the unit is shut down in the heading memory mode, the platform retains the true north information obtained from the above procedure. To align the unit by the heading memory method, the align mode switch is in the HDG MEM position. The power control knob is placed to align mode until the align light flashes and then to NAV. After the power control knob is in NAV, place the align mode switch to GYRO COMP (red guard down). If time permits, the system may be placed in the STBY mode until the heat light is extinguished, and then to ALIGN for greater system accuracy. On aircraft after TO 1F-4E-626, refer to TO 1F-4E-34-1-1-2 for DMAS heading memory alignment.

Inflight Alignment Procedure

Refer to Section III, this manual.

ATTITUDE REFERENCE SYSTEM

The AN/AJB-7 is a two gyro all attitude reference platform which supplies standby azimuth information to the attitude director indicator, the horizontal situation indicator, and the bearing distance heading indicator. Additionally, the AN/AJB-7 supplies standby attitude information to the attitude director indicator. It also provides a standby attitude horizon for the front and rear cockpit radar indicators. The rear cockpit attitude indicator, the autopilot, and the bombing computer receive attitude information from the AN/AJB-7 at all times. After TO 1F-4E-626, when data received from the IMU is determined to be invalid, the AN/AJB-7 attitude reference bombing computer set may be selected to supply pitch, roll, and magnetic heading signals to the DMAS by placing the STBY-PRIM switch to STBY. These signals provide secondary attitude and heading information to the DMAS and flight instruments.

After TO 1F-4E-671, if data from the INU is determined to be invalid NWDS automatically switches to AN/AJB-7 magnetic heading, and sets pitch and roll equal to zero for use by NWDS in its navigation and weapon release calculations. The NWDS will then supply the AN/AJB-7 pitch and roll data to the flight instruments with the STBY-PRIM switch still in PRIM.

Compass Controller

The compass controller provides the controls and indicator necessary for proper operation of the azimuth system. The mode selector knob initiates the proper relay switching in the compass adapter compensator to select the operating modes (compass, DG and slaved). The SYNC position of the mode selector knob, spring-loaded to return to the SLAVED position, is used for fast synchronization of the compass flux valve and the azimuth reference system. The degree of synchronization is indicated by the sync

indicator meter. The set heading control knob, spring-loaded to return to the center or zero position, manually adjusts the azimuth setting of the ADI, HSI and BDHI. When operating the compass system using the AJB-7 directional gyro (STBY selected on the reference system selector switch and DG on the mode switch), corrections for gyro precession are required to maintain system accuracy. Compensation is provided by the hemisphere switch (N-S) and the latitude control when they are set to the local hemisphere and latitude respectively.

REFERENCE SYSTEM SELECTOR SWITCH

The reference system selector switch on the ADI provides selection between the inertial navigation set and the AN/AJB-7 displacement gyroscope as the source of attitude information. The following inputs are provided by the inertial navigation set when the reference system selector switch is in PRIM, or by the AN/AJB-7 when the switch is in STBY.

a. Azimuth and attitude information to the attitude director indicator.
b. Azimuth information to the horizontal situation indicator.
c. Azimuth information to the bearing distance heading indicator (rear cockpit).
d. Attitude information to the fire control system.

NOTE

Primary (inertial) information is not available unless the selector switch on the inertial navigator control panel is in the NAV position.

When switching from STBY to PRIM or vice versa, attitude information appears almost immediately but may be accompanied by some unusual gyrations of the attitude director indicator. This phenomenon is a simultaneous large gyration about all three axes after which normal attitude reference is displayed. Whether or not this occurs is determined by which side of the AJB-7 is uppermost during the initial erection. Accurate heading information may not be immediately available when switching between PRIM and STBY, if the aircraft is in a turn having a turn rate of more than 15° per minute. In this condition, the fast synchronization feature of the compass is cut out. This is done to prevent erroneous heading errors resulting from turning errors which are generated in the flux gate compass. Switching between PRIM and STBY under the preceding conditions will result in random erroneous heading information. To correct this situation, the aircraft must be flown straight and level (rate of turn less than 15° per minute) for approximately 20 seconds and then manually synchronized by placing the compass controller mode switch to the SYNC position.

NOTE

The pilot may fast erect the AN/AJB-7 gyro platform by selecting the FAST ERECT position on the gyro switch. This applies an electrical cage signal to the gyro caging mechanisms. As the caging signal is applied, the aircraft should be in level, non-accelerating flight. The switch must not be held in FAST ERECT for more than 60 seconds or damage to the gyro may result. FAST ERECT should not be used to correct a heading error unless the preceding procedures have failed to correct the error.

OPERATING MODES

Compass Mode

The compass mode is considered an emergency mode. When the reference systems are not usable because of malfunctions, the compass mode provides a source of magnetic heading information to other aircraft systems. However, the interlock with the AFCS mode of operation of the automatic flight control system is automatically opened in the compass mode to prevent erratic magnetic heading signals from being applied to the autopilot. Also, the attitude director indicator azimuth indications should not be used since it is still connected to the malfunctioning reference system. To place the attitude reference system in the compass mode proceed as follows:

1. Mode switch on the compass controller - COMP

DG Mode

The DG mode is used in north and south latitudes greater than 70° and in areas where the earth's magnetic field is appreciably distorted. When the DG mode is initially selected, the magnetic heading of the aircraft must be set into the system with the set heading control on the compass controller. The system then uses this reference for subsequent heading indications. Apparent drift compensating voltages are inserted by use of the hemisphere switch (N-S) and latitude control on the compass system controller when operating with the reference system selector switch in the STBY (AN/AJB-7) position. However, when operating with the reference system selector switch in the PRIM (inertial) position, the latitude control knob must be set at zero, as a heading error is induced in the system if the control knob is set at any other value. To place the reference system in the DG mode proceed as follows:

1. Mode switch on compass controller - DG
2. Hemisphere switch - LOCAL HEMISPHERE
3. Latitude control knob - ZERO (with reference system selector switch in PRIM) - LOCAL LATITUDE (with reference system selector switch in STBY)
4. Aircraft magnetic heading - SET
   Set aircraft magnetic heading on the HSI, using the set heading knob.
5. Readjust the latitude control knob for each 2° change in latitude, if operating the reference system selector in STBY.

Slaved Mode

The slaved mode is the mode ordinarily used under normal conditions. In the slaved mode, the azimuth system is primarily controlled by signals from the compass transmitter (flux valve). Because system accuracy, is now dependent upon the earth's magnetic field, the slaved

mode should not be used in latitudes greater than 70° and in areas where the earth's magnetic field is distorted. To place the reference system in the slaved mode proceed as follows:

1. Mode switch on compass controller – SLAVED
2. Sync indicator meter – CHECK
   Allow 10 seconds for automatic fast synchronization and check the sync indicator meter for a center-scale indication. Slight deviation of the needle from the center position is corrected by normal sync.
3. Pitch trim control on ADI – ADJUST
   Adjust the pitch trim control on the ADI for zero pitch attitude.

NAVIGATION COMPUTER SET (AN/ASN-46A) (Before TO 1F-4E-626 and TO 1F-4E-671)

The AN/ASN–46A navigation computer set contains both a great circle and a rhumb line computer. The great circle computer is utilized at ranges of greater than 120 nautical miles. At 120 ±10 nautical miles, the set automatically switches to rhumb line computations. The navigation computer consists of a control panel and an amplifier computer. The set may be operated with the INS turned OFF (Air Data Mode). Readouts available from the navigation computer are the same in either mode, but more accurate in the inertial mode. When operating in the inertial mode, all inputs necessary for the operation of the navigation computer are supplied by the INS except initial aircraft position, initial magnetic variation, and the desired target coordinates, which must be provided by the operator. In the air data mode, the operator must continuously provide the navigation computer with true wind direction and velocity, magnetic variation, and desired target coordinates. True airspeed is provided by the air data computer (ADC); magnetic heading comes from the compass system. If a failure of the INS occurs, the navigation computer automatically transfers to the air data mode, which is indicated by the illumination of the AIR DATA MODE light on the computer control panel. The navigation computer provides the aircrew with the following readouts:

a. Aircraft present position in latitude and longitude, based on INS information in the inertial mode or dead reckoning computations in the air data mode.
b. The continuous great circle (over 120 NM) or rhumb line (under 120 NM) bearing and distance to either of two preset targets.
c. Aircraft ground speed.
d. Aircraft magnetic ground track.
e. Aircraft drift angle (magnetic heading relative to magnetic track).

Accuracy of the present position readout in the inertial mode is 3 nautical miles per hour, or less, circular error of probability. In air data mode, the accuracy of the present position readout depends primarily on the accuracy of the wind and magnetic variation information provided manually by the operator. Assuming correct wind and magnetic variation information, the accuracy of the equipment in air data mode is as follows:

a. Present position latitude (between 72° N or S latitude) ±17 nautical miles per hour of operation.
b. Present position longitude (between 72° N or S latitude) ±27 nautical miles per hour.

For purposes of discussion, the navigation computer can be divided into two functional sections; a present position computer, and a course and distance computer.

PRESENT POSITION COMPUTER

In the inertial mode, the present position computer functions to provide a readout of aircraft position in latitude and longitude. Prior to flight, the operator sets the initial position into the navigation computer present position counters. During alignment, these coordinates are also inserted into the INS. As the aircraft moves in any horizontal direction, the navigation computer receives change in latitude and longitude signals from the INS. The changing latitude and longitude signals are used to drive the present position counters, thereby continuously reflecting the aircraft's present position. In air data mode, the present position computer uses true airspeed from the ADC, wind and magnetic variation information manually set by the operator, and magnetic heading information from the compass system to compute ground speed and true course traveled. Ground speed is integrated with time to attain distance, which is converted to a change in latitude and longitude. The changing latitude and longitude is reflected in the present position counters, thereby providing a continuous dead reckoning aircraft position.

COURSE AND DISTANCE COMPUTER

The basis of course and distance computation at ranges greater than 120 nautical miles (great circle computer) is the solution of the spherical triangle, formed on the earth's surface by the geographic north pole (true north), the present position, and the preselected target or memorized coordinates. The rhumb line computer solves a plane right triangle whose known sides are the latitude and longitude difference between the present position and the selected target or memorized coordinates. The system automatically switches from great circle computations to rhumb line computations when the great circle range to the selected target is 120 ±10 miles.

NAVIGATION COMPUTER CONTROL PANEL

The navigation computer control panel contains all controls and counters necessary for the operation of the navigation computer.

Function Selector Knob

The function selector knob is a five–position rotary switch with positions of OFF, STBY, TARGET 1, TARGET 2, and RESET. The OFF position removes all power from the system. The STBY position supplies filament voltage to the amplifier computer but the latitude and longitude

integrator channels of the system are inoperative. The TARGET 1 position selects readouts of range and bearing to preselected coordinates set on the target counters. The TARGET 2 position selects range and bearing readouts referenced to memorized coordinates. The RESET position is used to place any desired set of coordinates into the memory circuits. Placing the knob to RESET causes the previously memorized coordinates to be lost. Moving the knob from RESET to any other position causes the coordinates appearing on the target counters to be memorized. A restriction on the knob prevents accidental switching to OFF or RESET. The knob must be pulled out slightly to override this restriction.

Wind Control Knobs

The wind control knobs consist of the wind speed and the wind from control knob. The wind speed control knob is used to manually insert the wind speed affecting flight into the system and is displayed on the wind speed counter. The wind from control knob is used to manually insert the true wind direction.

Magnetic Variation Control Knob

The magnetic variation control knob is used to manually insert the magnetic variation angle into the system.

Position Control Knobs

The position control knobs are used to manually insert present position latitude and longitude to establish an initial fix for the dead reckoning function of the navigation computer or as a reference for INS alignment. The position latitude and longitude counters continuously indicate the aircraft present position in degrees and minutes during flight.

Target Control Knobs

The target control knobs serve two purposes; one is to insert any desired set of coordinates (base, alternate target, or destination point) into the memory circuits of the system, the other is to manually insert the target latitude and longitude into the system. The system provides output displays to fly to memorized coordinates when the function selector knob is placed to TARGET 2, and to the coordinates appearing on the target counters when the function selector knob is placed to TARGET 1.

Position Update Switch

The position update switch is used to update the position latitude and longitude during flight. The switch positions are SET, NORMAL, and FIX.

Variation Sync Meter

The variation sync meter indicates the error in the manual magnetic variation setting during the inertial mode. Rotating the variation control knob in the appropriate direction centers the vertical bar in the variation sync meter, indicating that the correct magnetic variation is set on the variation counter. Rotation of the variation control knob in the air data mode has no effect on the meter.

Test Cap Off Light

This light illuminates when the test cap on the front of the amplifer-computer is not properly connected, or when the true airspeed circuit from the air data computer is open. Either condition will only affect computer operation in the air data mode.

Latitude and Longitude Sync Lights

The LAT and LONG sync lights illuminate when the latitude and longitude position counters do not agree with the inertial navigation set latitude or longitude output.

NAVIGATION COMPUTER OPERATION

All control knobs required to operate the navigational computer are on the computer control panel. To simplify the procedure, it should be understood that where a counter setting is specified, the control knob associated with the particular counter is rotated to set the counter. In the case of the position latitude and longitude counters and the magnetic variation counter, the associated control knobs must be pressed in to engage them with their respective counters before they can be rotated effectively.

OUTPUT DISPLAYS

The navigation computer display information in the front cockpit is shown in section I. To display navigation computer information on the BDHI, select the NAV COMP position on the navigation selection switch. The display information on the BDHI is as follows:

a. Magnetic bearing to target or base displayed on No. 1 pointer when read against the compass card. A relative bearing to the target or base can also be read by noting the number of degrees from the index clockwise to the No. 1 pointer.

b. Magnetic ground track displayed on No. 2 pointer when read against the compass card. Left or right drift angle can also be read by noting the number of degrees left or right from the index.

c. Distance to the target or base displayed on the range counter.

d. Magnetic heading when compass card is read under the index.

To travel the great circle route to the target or base, the aircraft should be flown on a course that causes the bearing and track pointers to be coincident. However, it is not necessary to fly the course shown by the coincidental pointers. Departure from the route may be made, as a part of evasive maneuvers or to fly a search pattern, without affecting the operation of the system. Since computations are being made continuously, the current position of the airplane is shown at all times on the position counters regardless of the path flown. As the target (or base) is approached, the distance on the range counter decreases. When the target is reached, uncertainty is exhibited by the No. 1 pointer which turns 180° as the target is passed in order to indicate bearing to target.

Updating Methods

The postion counters should be checked and updated at each opportunity by one of the following methods:

a. VISUAL/RADAR reference to a geographical position. Adjust the position latitude and longitude to agree with the latitude and longitude of the VISUAL/RADAR fix. This latitude and longitude may be obtained from maps, charts, or publications.
b. TACAN fix. Set the latitude and longitude of the acquired tacan station in the target counters or in base memory. Adjust the present position counters so that the No. 1 pointer and range counter on the BDHI agree with the tacan readout.
c. GCI or radar monitored fix. Set the latitude and longitude of the controlling agency in the target counters or in base memory. Adjust the position counters so that the No. 1 pointer and range counter on the BDHI agree with the bearing and distance provided by the controller.

Updating Procedures, Inertial Mode

Aircraft present position (represented by the position latitude and longitude counters) may be updated in the inertial mode as follows:

a. A few minutes before reaching the point of known coordinates, pull outward on the position update switch and place it to SET. This disengages the position latitude and longitude counters.
b. Rotate the position latitude and longitude control knobs until the coordinates of the approach point appear in the position latitude and longitude counters.
c. Place the position update switch to FIX and hold in this position.
d. When exactly over the known point, release the switch; it is spring-loaded and returns to the NORMAL position, completing the updating procedure.

The inertial navigation set updates at a rate of approximately 3 minutes of latitude and 3 minutes of longitude per second. For example, if the latitude was changed by 5 minutes and the longitude was changed by 15 minutes, the longitude change would determine the amount of time the position update switch must be held in FIX position. In this example, the position update switch must be held in the FIX position for a minimum time of 5 seconds prior to reaching the known point, otherwise the INS is only partially updated. When the position update switch is moved from SET to FIX, it must pass through NORMAL position. A time delay circuit in the computer control panel prevents the position counters from going to normal operation for about one-half second. Therefore, the switch movement from SET to FIX must be a smooth continuous movement in order to prevent an unwanted interval of NORMAL operation.

Updating Procedures, Air Data Mode

The aircraft present position may be updated in the air data mode by either of two methods. One method of updating is to rotate the position latitude and longitude control knobs until the coordinates of the aircraft actual present position appear in the position latitude and longitude counters. This may be accomplished with the function selector knob in any position except RESET or OFF. The other method utilizes the position update switch and has the advantage that the navigation computer may be instantaneously updated when the aircraft is over the point of known coordinates.

Leap Frog Operation

A leap frog type of operation may be used wherein the aircraft is normally flown in TGT 2 toward a memorized point. While enroute, the next point is set on the target counters. When the first destination (the initial TGT 2) is reached, the function selector knob is momentarily moved to RESET and then to TGT 2. When this is done, the target counter settings are transferred to the memory circuits and the coordinates of the point just reached are erased. The target counters are now free to receive new coordinates. While on the second leg, the target counters may be set to a third destination without interfering with steering to the second. When the second destination is reached, the procedure may be repeated and a fourth destination can be established while flying to the third. This procedure can be repeated as many times as desired.

NAVIGATION AND WEAPON DELIVERY SYSTEM (AN/ASQ-203) (After TO 1F-4E-671)

After TO 1F-4E-671, the AN/ASN-46A Navigation Computer Set is replaced by the AN/ASQ-203 Navigation and Weapon Delivery Sytem which performs all of the navigation computer functions. Refer to TO 1F-4E-34-1-1-3 for a detailed descripiton of the navigation function of NWDS.

AIR REFUELING SYSTEM

NOTE

Refer to foldout section for cockpit illustration.

The air refueling system utilizes a receptacle, aft of the rear cockpit, above the number 2 fuselage fuel cell. Actuation of the receptacle is controlled by the air refuel switch on the fuel control panel. Placing the air refuel switch to EXTEND, extends the receptacle, interrupts the fuel control panel continuity, and illuminates the air

refuel READY light. When the receptacle is extended, the air refueling lights (exterior) illuminate. With the receptacle extended, the pilot must fly a formation position with the tanker. The boom operator in the tanker then extends the boom into the receptacle. When the boom nozzle is seated in the receptacle, a solenoid actuated shuttle valve opens and directs utility hydraulic pressure to the two locking toggles in the refueling receptacle. These toggles grip the nozzle and lock the boom to the refueling receptacle. These toggles may be unlocked by the tanker when the tanker is in automatic mode. The tanker cannot release the toggles if refueling in TANKER MANUAL mode. The air refueling release button or the air refuel receptacle circuit breaker (No. 2 circuit breaker panel) will release the toggles regardless of the tanker refueling mode.

NOTE

- If the tanker informs the receiver that they are refueling in TANKER MANUAL mode, the receiver must initiate the disconnect by using the air refueling release button or pulling the air refuel receptacle circuit breaker.
- During any abnormal engagement, the automatic and tanker disengage features are lost and the receiver must initiate the disconnect.

Once the boom is locked in the receptacle; the READY light goes out and fuel is transferred (at a rate up to 3900 pounds per minute) to any fuel cell or tank that will accept it. An induction coil in the receptacle connects the receiver refueling amplifier and tanker electrical circuits. This illuminates the director lights, and establishes the automatic (tanker initiated) disengage capabilities. If the boom becomes disengaged, an air refuel DISENGAGED light illuminates indicating fuel transfer is interrupted. Once disengaged, the system must be reset to resume taking fuel. When the fuel system is reset, the READY light illuminates indicating a new hook-up can be made. At the completion of the air refueling sequence, the boom receptacle may be retracted and continuity restored to the fuel control panel, by placing the air refuel switch to RETRACT. On aircraft 67-398 and up, an amplifier override relay is added to the air refueling circuit to permit normal boom-receptacle engagement with a failed amplifier. For normal and emergency air refueling procedures refer to F/RF-4 Flight Crew Air Refueling Procedures (TO 1-1C-1-8).

Air Refuel Switch

The air refuel switch is a two-position toggle switch on the fuel control panel. Placing the air refuel switch to EXTEND, extends the boom receptacle, interrupts the normal continuity to the fuel control panel, depressurizes the tanks, turns on the hydraulic transfer pumps, and illuminates the air refuel READY light. The ready light will not illuminate until the receptacle is fully extended. After the boom is locked into the receptacle, fuel is transferred to any fuel cell or tank that will accept it. Fuel to each cell or tank is automatically shut off by its fuel level control valve. Three external tanks FULL indicator lights illuminate when the their respective tanks become full. Placing the air refuel switch to RETRACT, retracts the receptacle and restores normal continuity to the fuel control panel. The air refuel switch is used to reset the fuel system during air refueling by cycling from EXTEND to RETRACT and back to EXTEND. With the air refuel switch in EXTEND, pressurization to all internal and external fuel tanks is shut off and fuel will not transfer from internal wing or external fuel tanks. However, placing the internal wing dump switch to DUMP repressurizes the internal wing tanks and provides normal wing fuel dump. If receptacle door is damaged during refueling operations, pull the air refuel receptacle circuit breaker (D1, No. 2 panel) and place the air refuel switch to RETRACT to pressurize fuel tanks and transfer fuel.

Refuel Selection Switch

A two-position refuel selection switch, marked INT ONLY and ALL TANKS, is on the fuel control panel. The INT ONLY position closes the external tank(s) fuel shutoff valves allowing only the fuselage and wing tanks to be refueled. The ALL TANKS position opens the external tank(s) fuel shutoff valves, allowing all fuel tanks to be refueled.

Air Refueling Release Button

The refueling release button is a push-button type switch on the front cockpit stick grip. When release from the boom is desired, depress and hold the release button down until the air refuel DISENGAGED light illuminates. Throttle or attitude changes should not be made until the boom is clear of the receptacle. If the above methods of disengagement fail, pull the AIR REFUEL RECEPT circuit breaker (No. 2 circuit breaker panel). Once disengagement is effected, reset the circuit breaker.

Ready Light

The air refuel READY light indicates that the fuel system is being conditioned to receive fuel. On aircraft 66-284 thru 67-397, the READY light illuminates when the air refuel switch is placed to EXTEND. On aircraft 67-220 and up, the READY light illuminates when the air refuel receptacle is fully extended. The air refuel READY light remains illuminated until the boom is locked into the receptacle or the air refuel switch is placed to RETRACT.

Disengaged Light

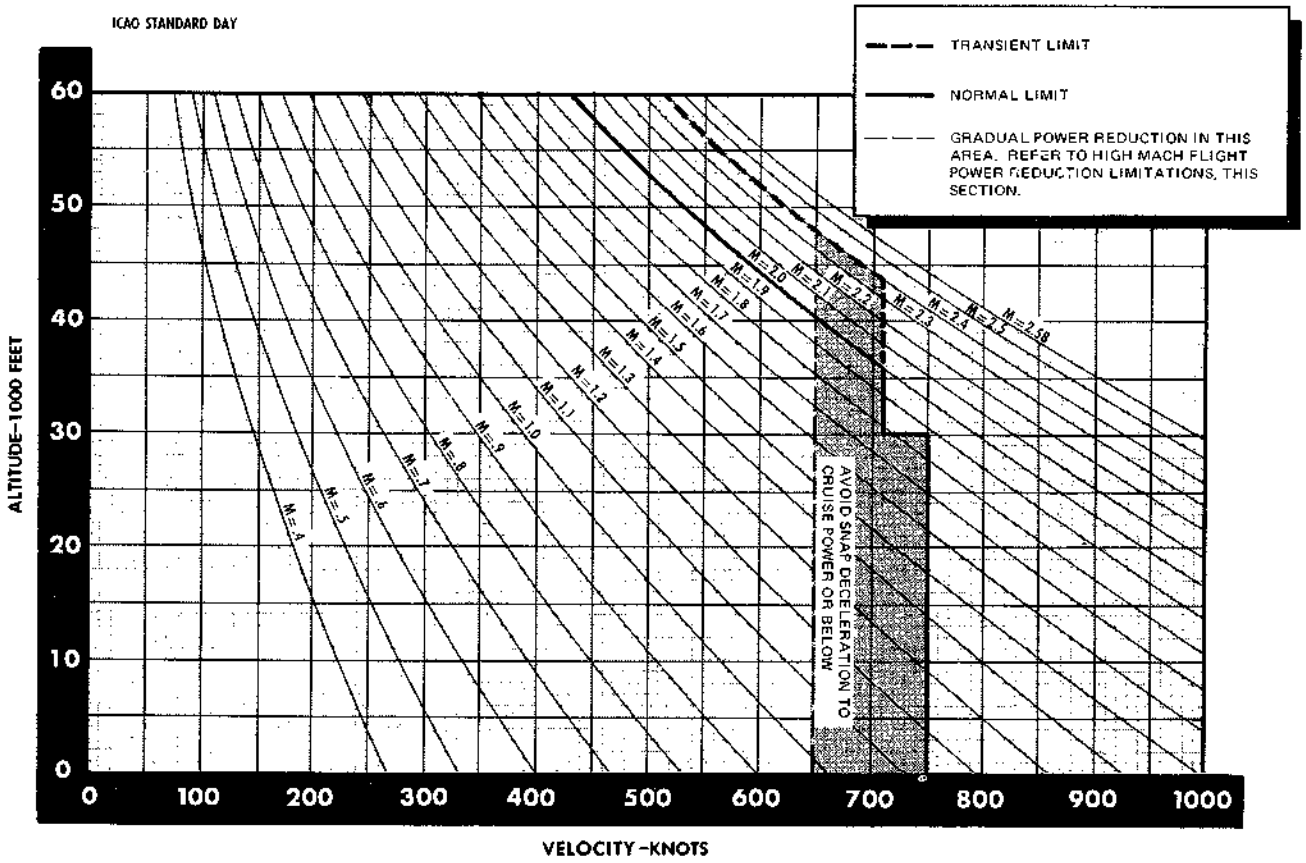
The air refuel DISENGAGED light indicates boom disengagement during the refueling cycle. The air refuel DISENGAGED light remains illuminated until the fuel system is reset to continue refueling, or the receptacle is retracted.

NOTE

- Illumination of the DISENGAGED light is not a positive indication of disconnect.
- On aircraft 67-398 and up, a marginal or improperly rigged contact limit switch can cause the DISENGAGED light to illuminate after the boom is locked in the receptacle. If this occurs, refueling can be continued using the procedures for a failed refueling amplifier.

AIRPLANE SPEED RESTRICTIONS

CLEAN OR (4) AIM-7 MISSILES



Note UNDER SOME CONDITIONS, MAXIMUM AIRSPEEDS ARE DETERMINED BY INLET TEMPERATURE LIMITATIONS AND TRANSIENT OPERATIONS LIMITATIONS. REFER TO ENGINE AIRSPEED LIMITATIONS CHART, THIS SECTION.

4E-1-(39) A

Figure 5-3

acceleration times with kerosene base fuels for the light-off for ground starts below 5°C (40°F).

Thrust is not degraded using alternate fuels. Airstart capability with an alternate fuel is not significantly different than with JP-4 provided the engine has not been inoperative for an extended time since the fuel entering the main fuel control will be warm.

A one time flight using an alternate fuel with the fuel controls specific gravity adjustment set for JP-4 is permissible; however, for optimum performance, the fuel controls should be set for the fuel in use. The following information is provided for comparison to operating on JP-4 with the fuel controls set for JP-4.

a. Fuel control set for JP-4, operating on JP-5 or JP-8.
   (1) Rapid throttle transients to MAX afterburner during maneuvering flight, at angle of attack greater than 24 units, increases the possibility of engine flameouts/compressor stalls.
   (2) Airstart capability does not change significantly when the engines have been shutdown for less than 1 minute. For shutdown times of 1-4 minutes, a general reduction in relight altitude of 6000 feet is realized.
   (3) The following restrictions apply. Ambient temperature must be above -20°F for engine start. Maximum rate of throttle movement allowed are 6 seconds IDLE to MIL, 3 seconds 85% to MIL and 3 seconds minimum AB to maximum AB. Stabilize engines at MIL prior to selecting minimum AB.

b. Fuel control set for JP-8, operation at JP-8.
   (1) For airstarts, the time required for ignition/throttle ON to idle rpm increased by 10 to 25 seconds.
   (2) There is no loss in afterburner light-off, nor any increase in susceptibility to engine compressor stall, or flameout during throttle transients.

For one time flight only, fuels may be intermixed during ground or air refueling operatings. No change in engine operating limitations or retrim is required.

NATO F-34 and F-44 may not contain corrosion inhibitor. NATO F-35, NATO F-43, JET A, and JET A-1 may not contain icing or corrosion inhibitors. Restrict operation without corrosion inhibitor to 10 consecutive hours. Restrict operation without icing inhibitor to one flight.

Alternate fuels except JET B are heavier than JP-4; refer to Fuel Quantity Data table, section I. The increased fuel weight will cause a CG shift of about 0.1% aft and an increase in range of about 5%.

EMERGENCY FUEL

In an emergency, the engines may be operated on MIL-G-5572B 115/145 AVGAS (NATO F-22) if JP-4 or an alternate fuel is not available. When AVGAS is used, the aircraft is restricted to one flight at subsonic speeds. AVGAS has a specific gravity range between 0.730-0.685. The pilot should be aware that the following degradations in engine performance will occur:

a. Longer time to start and accelerate, with possible missed-starts or start-stalls.
b. Maximum engine RPM and EGT may not be attained.
c. Slow acceleration throughout the operating range.
d. Lower than normal afterburner thrust.
e. Reduced aircraft range.

AIRSPEED LIMITATIONS

The maximum permissible airspeeds for flight in smooth or moderately turbulent air are shown in figure 5-3. Under some conditions, maximum airspeeds are determined by inlet temperature limitations and transient operations limitations; refer to Engine Airspeed Limits (figure 5-4). Limiting airspeeds for operation of various airplane systems are presented in figure 5-5.

NOTE

When flying below 10,000 feet, caution should be used when operating the aircraft above 0.87 Mach to preclude oscillations in case of stability augmentation failure.

ENGINE AIRSPEED LIMITS		
ALTITUDE RANGE	STEADY STATE LIMIT	TRANSIENT LIMIT
SEA LEVEL TO 30,000 FEET	POINT AT WHICH DUCT TEMP HI LIGHT ILLUMINATES (121 C), OR 750 KNOTS WHICHEVER OCCURS FIRST.	NONE
30,000 FEET AND UP	POINT AT WHICH DUCT TEMP HI LIGHT ILLUMINATES OR 710 KNOTS WHICHEVER OCCURS FIRST.	5 MINUTES PER FLIGHT ABOVE THE STEADY STATE LIMIT, NOT TO EXCEED 710 KNOTS OR .4 MACH ABOVE THE SPEED AT WHICH THE STEADY STATE LIMIT IS REACHED.

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Figure 5-4

AOA LIMITATIONS

The maximum allowable angle of attack is:

a. Above 35,000 feet - 25 units.
b. 35,000 feet and below - 30 units.

PROHIBITED MANEUVERS

a. Full-deflection aileron roll in excess of 360°
b. Full-deflection aileron roll into the heavy wing during supersonic asymmetric flight is prohibited.
c. Intentional spins.

GROSS WEIGHT LIMITATIONS

The maximum allowable gross weights are:

a. Without 26 ply tires, 58,000 pounds for any ground operation.
b. With 26 ply tires, 62,000 pounds for any ground operation.
c. 46,000 pounds for landing.

To estimate aircraft takeoff gross weight, refer to Airplane Loading chart in part 1 of Performance Data appendix A.

TOUCHDOWN LIMITATIONS

Refer to figure 5-6. The normal landing technique (outlined in section II) will result in descent rates of approximately 700 fpm during approach and 500 fpm touchdown at typical landing gross weights.

EXTERNAL STORES LIMITATIONS

TABLE OF CONTENTS

GENERAL

A. The minimum acceleration for release or employment in level flight is 1G. The minimum acceleration for employment or release in a dive delivery is the normal G loading for a given dive angle which can be obtained only when a wings level straight line flight path is maintained prior to release or employment.

B. Speeds or G quoted in the "employment" column are applicable to the dispensing limitations of the CBU's, the firing limitations of the guns, the launching limitations of the rockets and missiles, etc.

C. Speeds or G quoted in the "Release" column are applicable only to releasing the store from its suspension equipment.

D. Speeds quoted in the "Jettison" column are applicable to jettisoning the combined suspension equipment and store from the airplane.

E. The term "ripple" in the "External Stores Notes" applies to the single–ripple and single–continuous release modes.

F. Unless otherwise indicated in the "External Stores Notes" the minimum INTVL setting for the single–ripple and single–continuous release modes is .06 SEC.

G. Unless otherwise indicated in the "External Stores Notes" the minimum INTVL setting for the salvo release mode is .20 SEC when adjacent weapon stations are selected and .06 SEC when a single weapon station or non–adjacent weapon stations are selected.

H. With partially loaded MER/TER's, use a minimum interval of .09 SEC to step over one empty MER/TER position in the ripple or salvo mode. To step over two empty MER/TER positions, use a minimum interval of .14 SEC.

I. If the situation warrants, store(s) may be jettisoned with flaps and slats extended. However, release, jettison and employment of stores should be accomplished with slats in automatic operation only.

J. Refer to figure 5–8 for reduced acceleration G limits as a result of gross weight and Mach Number.

K. For asymmetric carriage, refer to Section VI, Flight With Asymmetric Loading.

L. Recommended release sequence is outboard to inboard. Releasing inboard stores prior to outboard may result in an aft CG shift. Under some circumstances the shift may exceed the aft CG limit.

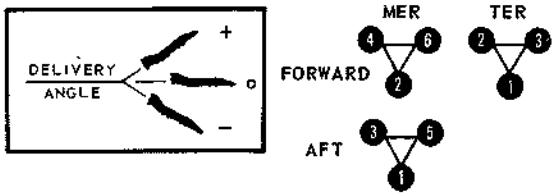
M. Captive AIM-9 missiles may be flown with wings, rollerons and/or fins/canards removed.

NA, Not Applicable/Authorized

NE, Not Established

Aircraft Limits.

Alternate Limitations – Either primary or alternate limitations apply to all configurations for station loading.



EXTERNAL STORES	SHEETS
CARGO POD	18 and 19
DISPENSERS AND CLUSTER BOMB UNITS	
BL-755	12 and 13
CBU-7 (SUU-13)	14 and 15
CBU-12 (SUU-7)	12 and 13
CBU-24 B/B	12 and 13
CBU-30 (SUU-13)	14 and 15
CBU-38 (SUU-13)	14 and 15
CBU-46 (SUU-7)	12 and 13
CBU-49 (SUU-30)	12 and 13
CBU-52 (SUU-30)	12 and 13
CBU-58 (SUU-30)	12 and 13
CBU-71 (SUU-30)	12 and 13
CBU-87/B	13A and 13B
CBU-89/B (GATOR MINE)	13A and 13B
CHAFF DISPENSERS	18 and 19
ROCKEYE II MK 20 MOD 2	14 and 15
SUU-20	14 and 15
SUU-21	14 and 15
ECM PODS	18 thru 19A
FLARE DISPENSERS AND FLARES	18 and 19
FUEL TANKS	2 and 3

GP BOMBS	SHEETS
BLU-109	11A and 11B
GP BOMBS WITH FUZE EXTENDERS	10 and 11
MATRA 250 Kg	7C and 7D
M36E2	4 and 5
M117D	8 and 9
M117GP (MAU-103A/B FIN)	8 and 9
M118GP	8 and 9
M129E1, M129E2, and MJU-1	8 and 9
MC-1 GAS BOMB	8 and 9
MK-36 DESTRUCTOR	10 thru 11
MK-81 LDGP	8 and 9
MK-82 LDGP	10 and 11
MK-82 SNAKEYE I/SNAKEYE (LD)	10 and 11
MK-82/BSU-49/B	4 and 5
MK-83 LDGP	10 and 11
MK-84 LDGP	10 and 11
MK-84/BSU-50/B	4 and 5
GUIDED BOMBS	22 thru 23B
GUN PODS	18 and 19
MISCELLANEOUS	21A thru 23
MISSILES	4 and 5
MISSILE MIXED LOADS	6 thru 7D
PRACTICE BOMBS	16 and 17
ROCKET LAUNCHERS (FFAR)	16 and 17
SPECIAL WEAPON BOMBS	2 thru 5
SPRAY TANKS	20 and 21
SUSPENSION EQUIPMENT	21A and 21B
TOW TARGET SYSTEM	20 and 21

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Figure 5–10 (Sheet 1 of 23)

EXTERNAL STORES LIMITATIONS

FUEL TANKS AND SPECIAL WEAPONS

STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON		
							AIRSPEED		ACCEL G		MIN	MAX	
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS	
600 Gallon High Performance Centerline Tank	Aero 27/A BRU-5/A	Empty, Subsonic		●			660	2.0	✈ ***	✈ ***	—	660 2.0 *	
		Empty, Supersonic		●					+6.5 -2.0	+5.2 0.0			
		Empty to Full		●					+5.0 -2.0	+4.0 0.0	—	560 2.0 **	
Royal Jet 600 Gallon Centerline Tank	Aero 27/A BRU-5/A	Empty to 10% Full		●			600	1.8	+5.0 0.0	+4.0 0.0	175	390	A
		10% Full to 75% Full		●			600	1.8	+5.0 0.0	+4.0 0.0	Not Authorized		
		75% Full to Full		●			600	1.8	+3.0 0.0	+2.0 0.0	175	390	
Sargent–Fletcher 370 Gallon Wing Tank	Pylon Installed as part of Wing Tank	●	Empty to 10% Full			●	750	1.6	+6.0 −2.0	+4.8 0.0	(1G Level Flight) 175 to 375 (2G Sym Flight) 400 to 445 (3G Sym Flight) 425 to 510		B
		●	10% Full to 75% Full			●	550	1.6	+5.0 −2.0	+4.0 0.0			
		●	75% Full to Full			●	550	1.6	+4.0 −1.0	+2.0 0.0			
B43 Bomb, or BDU–8/B Practice Bomb	Aero 27/A BRU-5/A			●			✈	✈	+6.5 −3.0	+5.2 0.0	175	✈	C
Maximum Load–3	MAU-12 (With Adapter)		●		●		750	1.8	+5.5 −2.0	+4.4 0.0	175	750	
B57 Bomb, B57 Type III Training Bomb or BDU–12/B Practice Bomb Maximum Load–3	Aero 27/A 30 inch BRU-5/A			●			✈	✈	+6.5 −3.0	+5.2 0.0	175	600	D
	MAU-12 14 inch		●		●		✈	✈	+5.5 −2.0	+4.4 0.0	175	550	
	MAU-12 14 inch (With Adapter)		●		●		750	1.8	+6.0 −3.0	+4.8 0.0	175	750	

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Figure 5–10 (Sheet 2 of 23)

FUEL TANKS AND SPECIAL WEAPONS

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAX KNOTS	MAX ACCEL G	MIN KNOTS	MAX KNOTS		
A	NA	NA	NA	NA	NA	NA	NA	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • Roll Rate: Empty – 200 deg/sec. Empty – to Full – 150 deg/sec. • Roll Acceleration: Empty – Full stick throw. Empty to Full – ½ stick throw. • Do not exceed on speed AOA unless the tank is completely full or empty. This AOA restriction does not apply to the modified High Performance Centerline tank with filler cap located on the rear of the tank. * Jettison 0.5G to 2.0G and above 13 feet. ** Jettison 0.5G to 1.0G and above 13 feet. *** Stores compatibility limit does not apply.
B	NA	NA	NA	NA	NA	NA	NA	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • (Full or Empty): Jettison between 350 and 390 knots below 15,000 may cause airplane contact and minor damage. • Roll rate limited to 60 deg/sec. • Catastrophic failure of the Royal Jet 600 gallon centerline tank may cause a severe pitch–up.
C	NA	NA	NA	NA	NA	NA	NA	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • (Empty to 10% Full): Roll rate is aircraft limits.
D	NA	NA	NA	*	175		*	• If gross weight is over 37,500 lbs refer to Acceleration Limitations Chart. • For approved stores to be carried with special weapons, refer to TO 1F-4-25-3. • Slatted aircraft with external fatigue strap are limited to 550 KIAS with special weapon on STA 5. * Refer to TO 1F–4C–25.
				+4.0 +1.0		750	+45° to –20°	• If gross weight is over 41,000 lbs, refer to Acceleration Limitations Chart. • For approved stores to be carried with special weapons, refer to TO 1F-4-25-3. • Carriage of one B43 or dummy unit imposes the following limitations in lateral control: • with a load factor of plus 1 – minimum speed is 140 KIAS • with a load factor of plus 2 – minimum speed is 175 KIAS • with a load factor of plus 3 – minimum speed is 220 KIAS • with a load factor of plus 4 – minimum speed is 260 KIAS • B43 with short time delay chute (0.4 sec.): maximum release is Mach 1.32. • Dummy Unit; maximum release is Mach .95.
	NA	NA	NA	*	175	600	*	• If gross weight is over 37,500 lbs on STA 5 or is over 41,000 lbs on STA 2&8 refer to Acceleration Limitations Chart. • (STA 1 & 5): Maximum release speed with short delay (.1 sec.) is 550 Knots or .95 Mach. (STA 2 & 8): Short time delay not authorized. • Slatted aircraft with external fatigue strap are limited to 550 KIAS with special weapon on STA 5. • For approved stores to be carried with special weapons, refer to TO 1F-4-25-3. * Refer to TO 1F-4C-25.
						550		
				+4.0 +1.0		750		

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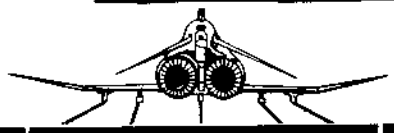
Figure 5–10 (Sheet 3 of 23)

EXTERNAL STORES LIMITATIONS

SPECIAL WEAPONS, MISSILES, AND BOMBS



STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM.	UNSYM.	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	MAX KNOTS
B61 Bomb, B61( ) Type III Training Bomb, or BDU-38/B Practice Bomb Maximum Load - 4	Aero-27/A BRU-5/A								+6.5 −3.0	+5.2 0.0	175	
	MAU-12 (With Adapter)						750	1.8	+6.0 −3.0	+4.8 0.0		750
AGM-45A, B ATM-45 Missile Maximum Load-4	LAU-34/A or LAU-118 Launcher								+6.0 −3.0	+4.8 0.0	175	550
Empty LAU-118 Launcher												
AGM-65A 65B, or 65D (Maverick) Missile Maximum Load -6 LAU-88-6 LAU-117-2 TGM-65 (Maverick Trainer) LAU-88-6 LAU-117-2 Maximum Load -6	LAU-88A, A/A Launcher								+6.0 −3.0	+4.8 0.0	175	550
	LAU-117/A,(V) 1/A Launcher											
Empty LAU-117 Launcher												
AIM-7E-3 and AIM-7E-3 with AN/AWM-19 AIM-7F Missiles Maximum Load-4	Aero-7A	MISSILE STATIONS 3		4	6	7					175	
		FWD										
		AFT										
M36E2 Cluster Incendiary Bomb Maximum Load-10	MER (Fwd)						550	0.9	+5.0 −1.0	+4.0 0.0	300	500
	TER										175	550
	MAU-12											
MK-82/BSU-49/B (AIR) Maximum Load: Single-24 Ripple-21	MER (FWD) Single or ripple release			**			600	1.2	+5.0 −1.0	+4.0 0.0	175	650
	TER Single or ripple release						650	1.4	+4.0 0.0	+3.2 0.0		550
MK-84/BSU-50/B (AIR) Maximum Load-4	MAU-12						600	1.3	+5.5 −3.0	+4.4 0.0	175	550
							700 *	1.4	+3.0 0.0	+2.4 0.0		

A B C D E F

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Figure 5-10 (Sheet 4 of 23)

SPECIAL WEAPONS AND MISSILES

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX	MIN	MAX	MAX	MIN	MAX		
	ACCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
A	NA	NA	NA	*	175	✈	*	• If gross weight is over 37,500 lbs on STA 5 or is over 41,000 lbs on STA 2 & 8, refer to Acceleration Limitations Chart. • For approved stores to be carried with special weapons, refer to TO 1F-4-25-3. * Refer to TO 1F-4C-25.
				+4.0 +1.0		750		
	*	175	✈	NA	NA	NA	+50° to −50°	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • The ATM-45 can be flown as a training missile without wings or fins. Jettison or installation of jettison cartridges is not authorized. • Roll rate limit is 200 deg/sec. * Refer to TO 1F-4C-34-1-2-1.
B	NA	NA	NA				NA	• Stores compatability does not apply. • Roll rate is aircraft limits.
	+3.0 +0.5	250	750	NA	NA	NA	Level to -60°	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • Speed brakes must be retracted when launching from stations 2 and 8. • CG position could become critical. • No other TGM-65 will be installed on the same launcher when one is equipped with recorder. • All partial load configurations are authorized without sequencing restrictions for AGM-65 and TGM-65.
C	NA	NA	NA				NA	• Stores compatability does not apply. • Roll rate is aircraft limits.
D	Sym 0.5 to +5.0 Unsym 0.5 to +4.0 *	220	✈	NA	NA	NA	NA	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • If the tank aboard relay is energized (TK light illuminated), the missiles mounted on fuselage stations 4 and 6 cannot be launched or jettisoned. • Roll rate is aircraft limits. • AIM-7F after TO 1F-4-1187. • Mixed load of AIM-7E and AIM-7F is not authorized. * For AIM-7F Refer to TO 1F-4C-34-1-2-1.
E	NA	NA	NA	+4.0	200	550	Level to −45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Nose cone removed.
					175			
F	NA	NA	NA	+4.0 +0.8	175	650	+35° to −35°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Simultaneous release from TER and centerline MER is prohibited • To prevent bomb-to-bomb collision when released from stations 1, 5, and 9; select an interval setting which will provide 0.20 seconds or greater between tandem bomb releases on each station. ** Loading on station 5 is restricted to MER stations 1, 4, and 6 whenever ripple release mode is selected.
						550		
	NA	NA	NA	+4.0	175	600	+35° to −35°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. * Maximum carriage airspeed is 635 KCAS/1.2 Mach with the MK-84 on stations 1 and/or 9.
				+3.0	175	*650		

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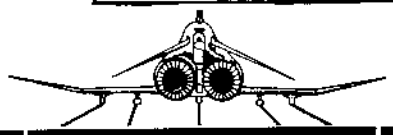
Figure 5-10 (Sheet 5 of 23)

EXTERNAL STORES LIMITATIONS

MISSILES AND MIXED LOADS



STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON		
							AIRSPEED		ACCEL G		MIN	MAX	
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS	
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with ALQ-71(V)-2, 71(V)-3, ALQ-72, ALQ-87	Aero-3/B with 3-inch spacer on MAU-12 Pylon						*	*	+6.0 -3.0	+4.8 0.0	175	750	
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with ALQ-101(V)-10													
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with MK-82 LDGP or Snakeye, CBU-52B/B, CBU-58/B, A/B, CBU-71B, A/B, MK-20, GBU-12 B/B, C/B, D/B	Aero-3/B with 3-inch spacer with Special Weapons Adapter on MAU-12 Pylon with 2½-inch swaybrace bolts and TER						550	1.1	+5.0 -1.0	+4.0 0.0	175	550	A
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with AGM-45 and ATM-45	Aero-3/B with 3-inch spacer with Special Weapons Adapter with LAU-34 launcher on MAU-12 Pylon with 2½-inch swaybrace bolts								+6.0 -3.0	+4.8 0.0	175	550	B
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with AGM-65 and TGM-65	Aero-3/B with 3-inch spacer with Special Weapons Adapter with LAU-117 launcher on MAU-12 Pylon with 2½-inch swaybrace bolts								+6.0 -3.0	+4.8 0.0	175	550	C
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with CBU-87/B	Aero-3/B with 3-inch spacer with Special Weapons Adapter on MAU-12 Pylon with 2½-inch swaybrace bolts and TER						550	0.95	+5.0 -1.0	+4.0 0.0	175	500	D
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with CBU-89/B Gator Mine	Aero-3/B with 3-inch spacer with Special Weapons Adapter on MAU-12 Pylon with 2½-inch swaybrace bolts and TER						550	0.95	+5.0 -1.0	+4.0 0.0	175	550	E

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Figure 5-10. (Sheet 6 of 23)

MISSILES AND MIXED LOADS

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAX KNOTS	MAX ACCEL G	MIN KNOTS	MAX KNOTS		
A	**	175	750	NA	NA	NA	NA	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • Cartridges are not to be installed in MAU-12 pylon. * Aircraft limits except with MK-8 warhead; see figure 5-11. ** Refer to TO 1F-4C-34-1-2-1.
B	+5.0	175	550	+4.0 *	175	550 **	+60° to -60° ***	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • Roll rate limit is 120 deg/sec. • CBU-52/58/71 release and jettison limits are 0.9 Mach. * 5G for MK-82 LDGP, Snakeye 1 and GBU-12B/B, C/B, D/B ** 500/0.9 Mach for MK-82 Snakeye 1 High Drag. *** -45° to +45° for GBU-12B/B, C/B, D/B; -60° to +45° for MK-20; Level to -60° for MK-82 Snakeye 1.
C	+1.0 (A)M-9) * AGM-45	175	✈	NA	NA	NA	+50° to -50°	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. * Refer to TO 1F-4C-34-1-2-1.
D	+3.0 +0.5	250	750	NA	NA	NA	Level to -60°	• If gross weight is over 45,000 lbs. refer to Acceleration Limitation Chart. • To ensure fins open, fin release wire is hardwired to swaybraces. • Roll rate limit is 120 deg/sec.
E	+5.0	175	550	+4.0 +0.7	175	550	+45° to -45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • To ensure fins open, fin release wire is hardwired to swaybraces.
	+5.0	175	550	+4.0	175	550	+45° to -45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitation Chart. • To ensure fins open, fin release wire is hardwired to swaybraces.

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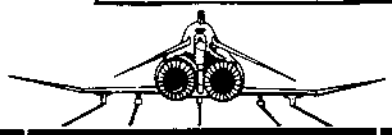
Figure 5-10 (Sheet 7 of 23)

EXTERNAL STORES LIMITATIONS

MISSILES AND MIXED LOADS



STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT		
							AIRSPEED		ACCEL G		JETTISON		
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	MIN KNOTS	MAX KNOTS	
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) Maximum Load - 4	Aero-3/B Launcher (with or without 3-inch spacers)						**	**	***	***	NA	NA	A
AIM-9 (Captive Training Missile) with BDU-33B/B, D/B	Aero-3/B with 3-inch spacer on MAU-12 Pylon and TER						550	0.95	+5.0 -1.0	+4.0 0.0	175	550	B
AIM-9 (Captive Training Missile) with MXU-648 A/A, C/A Cargo pod	Aero-3/B with 3-inch spacer on MAU-12 Pylon						550	0.95	+5.0 -1.0	*	NA	NA	C
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with BLU-107/B DURANDAL	Aero-3/B with 3-inch spacer with Special Weapons Adapater on MAU-12 Pylon with 2½-inch swaybrace bolts and TER						600	0.95	+5.0 -1.0	+4.0 0.0	175	550	D
AIM-9L/M with MK-82 LDGP or Snakeye, CBU-52B/B, CBU-58/B, A/B, CBU-71B, A/B, GBU-12B/B, C/B, D/B, MK-20	LAU-105 with double 3-inch spacers with special Weapons Adapter on MAU-12 Pylon with TER-9A						550	1.1	+5.0 -1.0	+4.0 0.0	175	550	E
AIM-9L/M with AGM-65A/B/D and TGM-65	LAU-105 with double 3-inch spacers with Special Weapons Adapter on MAU-12 Pylon with LAU-117 Launcher								+6.0 -3.0	+4.8 0.0	175	550	F
AIM-9L/M and CATM-9L/M	LAU-105 with single or double 3-inch spacers								**	**	NA	NA	

4E-1-(91-7.1)53

Figure 5-10 (Sheet 7A of 23)

MISSILES AND MIXED LOADS

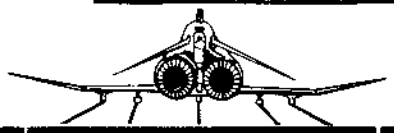
	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAX KNOTS	MAX ACCEL G	MIN KNOTS	MAX KNOTS		
A	*	175	750	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Roll rate limit is 200 deg/sec. * Refer to TO 1F-4C-34-1-2-1. ** Aircraft limits except with MK-8 warhead, see figure 5-11. *** Stores compatability limit does not apply.
B	NA	NA	NA	+5.0	175	550	+60° to −60°	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Roll rate limit 200 deg/sec. ● After release of all BDU-33 bombs, AIM-9 limitations are authorized.
C	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Cartridges are not to be installed in MAU-12 pylon. * Limit for A/A +3.0 to 0.0; for C/A +4.0 to 0.0.
D	NA	NA	NA	+1.0	175	600	+5° to −5°	● If gross weight is over 45,000 lbs. refer to Acceleration Limitations Chart. ● Minimum intervalometer settings: TER = 0.100 Ripple = Single and Pairs ● Simultaneous release from TER and centerline MER is prohibited. ● For TER carriage, the aft set of lug wells must be used.
E	+5.0	175	550	+4.0 *	175	550 **	+60° to -60° ***	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Roll rate limit is 120 deg/sec. ● CBU-52/58/71 release jettison limits are 0.9 Mach. * 5G for MK-82 LDGP, Snakeye 1 and GBU-12 B/B, C/B, D/B. ** 500/0.9 Mach for MK-82 Snakeye 1 High Drag. *** −45° to +45° for GBU-12 B/B, C/B, D/B; +45° to −60° for MK-20; level to −60° for MK-82 Snakeye 1.
F	+3.0 +0.5	175	750	NA	NA	NA	Level to -60°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Roll rate limit is 120 deg/sec.
	*	175	750	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Roll rate limit is 120 deg/sec. * Refer to TO 1F-4C-34-1-2-1. ** Stores compatability does not apply.

4E-1-(91-7.2)53

Figure 5-10 (Sheet 7B of 23)

EXTERNAL STORES LIMITATIONS

MISSILES, MIXED LOADS, AND BOMBS



STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON		
							AIRSPEED		ACCEL G		MIN	MAX	
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS	
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with BDU-33B/B, D/B	Aero-3/B with 3-inch spacers with Special Weapons Adapter on MAU-12 Pylon with 2 1/2-inch swaybrace bolts and TER-9A						550	0.95	+5.0 -1.0	+4.0 0.0	175	550	A
AIM-9L/M and CATM-9L/M with BDU-33B/B, D/B	LAU-105 with double 3-inch spacers with Special Weapons Adapter on MAU-12 Pylon with 2 1/2-inch swaybrace bolts and TER-9A						550	0.95	+5.0 -1.0	+4.0 0.0	175	550	
AIM-9B/E/J/N/P/P-4 (basic, -1, -2 & -3 Configuration and Captive Training Missile) with MXU-648A/A, C/A Cargo Pod	Aero-3/B with 3-inch spacers with Special Weapons Adapter on MAU-12 Pylon with 2 1/2-inch swaybrace bolts						550	0.95	+5.0 -1.0	*	NA	NA	B
AIM-9L/M and CATM-9L/M with MXU-648A/A, C/A Cargo Pod	LAU-105 with double 3-inch spacers with Special Weapons Adapter on MAU-12 Pylon with 2 1/2-inch swaybrace bolts						550	0.95	+5.0 -1.0	*	NA	NA	C
Matra 250 Kg Bomb (unretarded) Maximum Load-6	TER-9A						500	0.9	+5.0 -1.0	+4.0 0.0	175	500	D

4E-1-(91-7.3)53

Figure 5-10 (Sheet 7C of 23)

MISSILES, MIXED LOADS, AND BOMBS

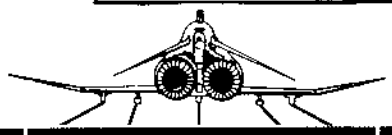
	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX	MIN	MAX	MAX	MIN	MAX		
	ACCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
	NA	NA	NA	+5.0	175	550	+60° to −60°	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Roll rate limit is 200 deg/sec. ● After release of all BDU-33 bombs, AIM-9 limitations are authorized.
A	NA	NA	NA	+5.0	175	550	+60° to −60°	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Roll rate limit is 200 deg/sec. ● After release of all BDU-33 bombs, AIM-9 limitations are authorized.
B	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Cartridges are not to be installed in MAU-12 pylon. * A/A +3.0 to 0.0; C/A +4.0 to 0.0.
C	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Charts. ● Cartridges are not to be installed in MAU-12 pylon. * A/A +3.0 to 0.0; C/A +4.0 to 0.0.
D	NA	NA	NA	+1.0 +0.8	175	500	Level to −20°	● If gross weight is over 45,000 lbs, refer to Acceleration Limitation Chart ● Minimum ripple release interval is 0.14 seconds. ● Configure MAU-12 bomb rack with two ARD-863-1 cartridges and two 0.081-inch diameter dash three orifices. ● Configure TER ejector units with one ARD-863-1 cartridge. ● This munition is certified only for the contingency rearming of USAF aircraft at allied bases with this munition from allied inventories.

4E-1-(91-7.4)53

Figure 5-10 (Sheet 7D of 23)

EXTERNAL STORES LIMITATIONS

GP BOMBS



STORE	SUSPENSION		STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON		
								AIRSPEED		ACCEL G		MIN	MAX	
			1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS	
M117 GP Bomb Maximum Load–17	MER (fwd)							550	1.1	+5.0 –1.0	+4.0 0.0	275	550	
								600	1.3	+3.0 0.0	+2.4 0.0			
												275	450	
	TER											275	550	
M117D (Destructor) M117R (Retarded) M117R (Low Drag Configuration), W/MAU–91 A/B, B/B Fin Maximum Load Single – 16 Ripple – 4	MER (Fwd)	Single Release Only						550	1.1	+5.0 –1.0	+4.0 0.0	375	500	A
								600	1.3	+3.0 0.0	+2.4 0.0			
												275	450	
	TER											175	550	
M118GP Bomb	AERO–27/A or BRU–5/A							600	1.1	+5.0 –1.0	+4.0 0.0	175	600	B
M129E1, M129E2 Leaflet Bomb and MJU-1 Chaff Bomb Maximum Load–18	MAU–12							550	1.1	+5.0 –1.0	+4.0 0.0	175	550	C
	MER (Fwd)											275	550	
												275	450	
	TER											175	550	
MC–1 Gas Bomb Maximum Load–17	MAU–12							550	1.1	+5.0 –1.0	+4.0 0.0	175	550	D
	MER (Fwd)											275	550	
												275	450	
	TER											175	550	
MK 81 LDGP Bomb Maximum Load–24	MER (Fwd)							550	1.1	+5.0 –1.0	+4.0 0.0	275 Single Speed 275		E
												175	450	
	TER											175	550	
														F

4E-1-(91-8)K

Figure 5-10 (Sheet 8 of 23)

GP BOMBS

EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
MAX	MIN	MAX	MAX	MIN	MAX		
ACCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
NA	NA	NA	+4.0 +0.7	175	550	+45° to −45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Maximum jettison and release is 0.95 Mach.

4E-1-(91-11.2)53

Figure 5-10 (Sheet 11B of 23)

EXTERNAL STORES LIMITATIONS

DISPENSERS AND CLUSTER BOMB UNITS

STORE	SUSPENSION		STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	AIRSPEED MACH	ACCEL G SYM.	ACCEL G UNSYM.	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	JETTISON MAX KNOTS	
BLU-52/B, A/B (CS-1 Filled) Maximum Load-4	MER (Aft)							550	1.1	+5.0 −1.0	+4.0 0.0	275	500	
								600	1.3	+3.0 0.0	+2.4 0.0	250	500	
	MAU-12											175	550	
CBU- 12/A 12A/A 46/A, A/A	SUU- 7B/A 7C/A 7C/A	MER (Fwd)	FULL					550	1.1	+5.0 −1.0	+4.0 0.0	325 Single Speed 325		A
			EMPTY									300 Single Speed 300		
Dispenser and Bomb Maximum Load-5														
CBU- 24B/B 49B/B 52/B 58/B, A/B 71/B, A/B	SUU- 30B/B 30H/B 30H/B 30H/B 30B/B	MER (Fwd)						550	1.1	+5.0 −1.0	+4.0 0.0	300	500	B
		TER						600	1.3	+3.0 0.0	+2.4 0.0	175	500	
		MER (Fwd)										375	500	
Dispenser and Bomb Maximum Load -15		MAU-12										175	550	
BL-755 Cluster Bomb (MK 1, MK 2 No. 1, and MK 2 No. 1A)		TER						550	1.1	+5.0 −1.0	+4.0 0.0	175	550	C
Maximum Load-6		MER (Fwd)						600	1.3	+3.0 0.0	+2.4 0.0	300	500	

4E-1-(91-12)U

Figure 5-10 (Sheet 12 of 23)

DISPENSERS AND CLUSTER BOMB UNITS

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAX KNOTS	MAX ACCEL G	MIN KNOTS	MAX KNOTS		
	NA	NA	NA	+3.0	175	600	+10° to −30°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • MER: Minimum Release Interval Setting is 100 msec.
A	1	450	550	1	275	550	EMPLOY 0° to −30° RELEASE Level	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • SUU−7 dispensers that have ballast bands can be expected to safely separate from aircraft stations 1 and 9 when released in 1G straight and level flight. RElease from the bottom aft MER stations between 475 and 550 knots, as close as possible to 515 knots. Release from the outboard MER stations between 375 and 475 knots, as close as possible to 415 knots. • Tube extensions are required on all dispensers. • A ballast ring must be installed on all dispensers, except SUU−7C/A. • After employment, the SUU−7 dispenser shall be released or jettisoned before landing. This is to preclude return to base of any non−ejected or partially ejected munitions.
	NA	NA	NA	1	325	500	Level	
B	NA	NA	NA	+4.0	175	550	+60° to −60°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Maximum release is .9 Mach.
C	NA	NA	NA	+5.0 to +0.9	175	550	Level to −20°	• If gross weight exceeds 45,000 lbs., refer to Acceleration Limitations Chart. • Minimum release air speed for station 5 does not attest to weapons ability to function at this speed. • Minimum ripple release interval is 0.14 seconds. • The BL−755 series cluster bombs have not received safety certification by USAF Non−nuclear Munitions Safety Board (NNMSB). • This munition is certified only for the contingency reaming of USAF aircraft at allied bases with this munition for allied inventories.
					175	500		

4E−1−(91−13)W

Figure 5−10 (Sheet 13 of 23)

EXTERNAL STORES LIMITATIONS

DISPENSERS AND CLUSTER BOMB UNITS

STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON	
							AIRSPEED		ACCEL G		MIN	MAX
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS
CBU-89/B GATOR MINE	MER (FWD)						550	0.95	+5.0 to -1.0	+4.0 to 0.0	300	500
Maximum Load-18											375	
	TER										175	550
	MAU-12						600	1.1				600
CBU-87/B CEM	MER (fwd)						550	0.95	+5.0 -1.0	+4.0 0.0	300	500
											375	
	MAU-12						600	1.1			175	600
	TER						550	0.95				500

A

4E-1-(91-13.1)53

Figure 5-10 (Sheet 13A of 23)

DISPENSERS AND CLUSTER BOMB UNITS

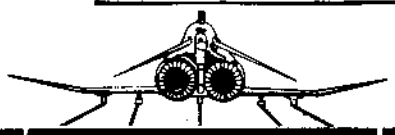
EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
MAX	MIN	MAX	MAX	MIN	MAX		
ACCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
NA	NA	NA	+4.0	175	550	+45° to -45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • (STA 1, 5, 9): To prevent bomb-to-bomb collision from MER stations, release interval must be 0.20 second or greater between tandom bomb releases on each station. • To ensure fins open, fin release wire is hardwired to swaybraces. • (STA 5): BRU-5A Screwjack jam nuts must be safety wired.
					600		
A							
NA	NA	NA	+4.0 to +0.7	175	550	+45° to −45°	• Maximum roll rate is limited to 120 degrees/second. • Jettison limits are for emergency jettison only.
					600		
					550		

4E-1-(91-13.2)53

Figure 5-10 (Sheet 13B of 23)

EXTERNAL STORES LIMITATIONS

DISPENSERS AND CLUSTER BOMB UNITS



STORE	SUSPENSION		STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	AIRSPEED MACH	ACCEL G SYM.	ACCEL G UNSYM.	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	JETTISON MAX KNOTS	
UNFINNED CBU– / SUU–	MER (Fwd)	FULL	▼				▼	550	0.9	+5.0 −1.0	+4.0 0.0	275	400	
7A/A 13A/A; 30/A 13/A; 38/A 13A/A; 38A/A 13B/A; 38B/A, C/A 13C/A					▼									
					▼									
	TER			▼		▼						250	450	
				▼		▼								
Dispenser and Bomb Maximum Load–18	MER (Fwd)	EMPTY	▼				▼	550	0.9	+5.0 −1.0	+4.0 0.0	400	400	
					▼							275	375	
					▼									
	TER			▼		▼						250	450	
				▼		▼								
Mk 20 Mod 2, 3, 4 CLUSTER BOMB (ROCKEYE II) Maximum Load–12	MER (Fwd)				▼			550	1.1	+5.0 −1.0	+4.0 0.0	175	450	A
					▼									
	TER			▼		▼						175	550	
SUU–20/A SUU–20A/A SUU–20A/M SUU–20B/A Bomb and Rocket Dispenser with MK 106, BDU–33B/B, D/B Maximum Load–2	MAU–12			▼		▼		550	1.2	+5.0 −2.0	+4.0 0.0	375 Single Speed 375		B
								650	1.3	+3.0 0.0	+2.4 0.0			
SUU–21/A Bomb Dispenser with MK 106 BDU–33B/B, D/B	Aero 27/A or BRU–5/A				▼			550	1.3	+6.5 −3.0	+5.2 0.0	NA	NA	C
Maximum Load–5	MAU–12		▼	▼		▼	▼	550	1.1	+5.5 −1.0	+4.4 0.0	NA	NA	

4E–1–(91–14)U

Figure 5–10 (Sheet 14 of 23)

PRACTICE BOMBS AND ROCKET LAUNCHERS (FFAR)

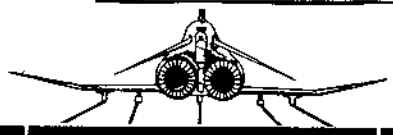
	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAX KNOTS	MAX ACCEL G	MIN KNOTS	MAX KNOTS		
	NA	NA	NA	+5.0	175	550	+60° to −60°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart.
A	+5.0	300	450	+1.0	175	275	Employ 0° to -60° Release Level	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • When carrying tanks on stations 1 and/or 9, do not release rocket pods (either full or empty) from the outboard shoulder of TER's on stations 2 and 8. • Nosecone and/or tailcone failure can be expected at speeds above 400 knots. • Speed brakes must be retracted when launching from stations 2 and 8. • If stores are installed at staions 4 and 6, do not launch rockets from station 5. • Maximum release and employment is .9 Mach.
					225	400		
					175	450		
					250	500		
	NA	NA	NA		300	350	Level	
					225	375		
					350	500		
					175	550		
B	+5.0	175	550	+1.0	275	550	Employ 0° to -60° Release Level	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Maximum release and employment is .9 Mach. • Speed brakes must be retracted when launching from stations 2 and 8.
					175	450		
C	+5.0 +0.5	175	550	+1.0	200	450	0° to -45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Roll rate is limited to 120 deg/sec. • Maximum employment is .95 Mach. Reduce employment limit to 525 KCAS for dive angles above 15 degrees. • LAU-131 tail fairing must not be installed. • Release limits apply to the release off the LAU-131 launchers only.

4E-1-(91-17)51

Figure 5-10 (Sheet 17 of 23)

EXTERNAL STORES LIMITATIONS

DISPENSERS, CARGO, ECM AND GUN PODS



STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON		
							AIRSPEED		ACCEL G		MIN	MAX	
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS	
ALE-38 Chaff Dispenser Maximum Load-2	MAU-12		●		●		550	1.2	+4.0 0.0	+3.2 0.0	275	375	
ALE-40 Flare/Chaff Dispenser (2 Disp per pylon) Maximum Load-4	MAU-12		▮		▮		✈	✈	✈ *	✈ *	NA	NA	A
SUU-16/A, SUU-23/A Gun Pod Maximum Load-3	MAU-12	●				●	✈	✈	+6.0 -3.0	+4.8 0.0	250	325	B
	℄ Adapter			●					✈ *	✈ *			
GPU-5/A 30-MM Gun Pod Maximum Load -1	Aero-27/A BRU-5/A			●			600	1.2	+5.0 -1.0	+4.0 0.0	175	300	C
							750	1.2	+3.0 -1.0	NA			
SUU-25B/A Flare Dispenser With LUU-1/B, -2/B, -2A/B, -2B/B, -5/B Maximum Load -6	MAU-12	●				●	550	1.1	+5.0 -1.0	+4.0 0.0	250	450	D
	MER (Fwd)			◁●							200	300	
		◁●				◁●					400	450	
SUU-25C/A and SUU-25E/A Flare Dispenser with LUU-1/B, -2/B, -2A/B, -2B/B, -5/B Maximum Load -6	MAU-12	●				●	550	1.1	+5.0 -1.0	+4.0 0.0	325	550	E
	MER (Fwd)	◁●				◁●					400	450	
				◁●							200	300	
MXU-648A/A Cargo Pod	MAU-12		●		●		550	0.95	+5.0 -1.0	+3.0 0.0	NA	NA	F
MXU-648C/A Cargo Pod										+4.0 0.0			
ALQ-101(V)-10 ALQ-119(V)-15, -17 ALQ-131(V)-4, -5, -6, -9, -10 ALQ-176 ALQ-184(V)-1, -2 QRC 80-01(V) ECM Pod	MAU-12		●		●		✈	✈	✈	✈	NA	NA	G
	Missile Well Adapter	MISSILE STATIONS											
			3	4	6	7							
				●									

4E-1-(91-18)53

Figure 5-10 (Sheet 18 of 23)

DISPENSERS, CARGO, ECM AND GUN PODS

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX	MIN	MAX	MAX	MIN.	MAX		
	ACCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
A	+4.0	175	550	NA	NA	NA	NA	● Maximum jettison is .9 Mach.
B	✈	✈	✈	NA	NA	NA	NA	● Can be combined with any store authorized for carriage on stations 2 and 8, or with any stores depicted in combination for carriage on stations 2 and 8. ✱ Stores compatability limit does not apply.
C	✈	✈	✈	NA	NA	NA	Employ Level to −60°	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Roll rate is 200 deg/sec. ✱ Stores compatibility limit does not apply.
D	+5.0 0.0	175	600	NA	NA	NA	Level to −60°	● If gross weight is over 37,500 lbs, refer to Acceleration Limitation Chart. ● No stores are to be loaded in forward missile wells. ● Symmetrical flight only above 600 knots.
E	+1.0	275	550	+1.0	250 250 (FULL) 500 100 (EMPTY) 500 350	450 450	Employ and Release Level	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● Release and Jettison Full or Empty.
F	+1.0	275	550	+1.0	325	525	Employ and Release Level	● If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. ● The 5−ohm resistor switch on front of SUU−25E/A must be in the OUT position when carried on any station.
G	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 45,000 lbs. refer to Acceleration Limitations Chart. ● Max roll rate is 120 deg/sec. ● Cartridges are not to be installed in MAU−12 pylon.
	NA	NA	NA	NA	NA	NA	NA	● If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. ● Roll rate is aircraft limits. ● Cartridges are not to be installed in MAU−12 pylon. ● (STA 4) with ALQ−131, Nose Gear may be slow to retract.

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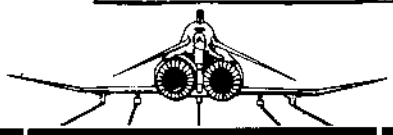
Figure 5−10 (Sheet 18A of 23)

EXTERNAL STORES LIMITATIONS

ECM PODS



STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON	
							AIRSPEED		ACCEL G		MIN	MAX
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS
ALQ-131(V)-12, -13, -14, -15 ECM Pod	MAU-12		●		●		600	1.6	+6.0 -3.0	+4.8 0.0	NA	NA
	Missile Well Adapter	MISSILE STATIONS										
			3	4	6	7						
				●								
ALQ-188 ECM Pod	MAU-12		●		●		✈	✈	✈	✈	NA	NA

A

4E-1-(91-19)51

Figure 5-10 (Sheet 19 of 23)

SPRAY TANKS AND TARGETS

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX	MIN	MAX	MAX	MIN	MAX		
	ACCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
	+0.82 +5.0	300	575	+1.0	275	575	Level to -20°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Lower tail fins must be removed. • Maximum roll rate is 80 deg/sec. • Maximum employment is .95 Mach. • After employment, the dispenser shall be released or jettisoned before landing. • For additional information refer to Joint Munitions Effectiveness Manual (JMEM)
A	NA	NA	NA	NA	NA	NA	NA	• If gross weight is over 45,000 lbs. refer to Acceleration Limitations Chart. • Maximum crosswind component for takeoff or landing with a stowed target is 15 knots.
				+1.0	200	220	Straight and Level	✱ 275 knots is permissible under non-turbulent flight conditions. Only gradual coordinated turns (max bank angle of 20°) are permitted.
	+5.0	200	500	NA	NA	NA	NA	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Only gradual coordinated turns are permitted.
B	NA	NA	NA					• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • After tow cable is cut.
	NA	NA	NA	+1.0	220	250	Straight and Level ✱✱	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Jettison with landing gear down is not recommended. • Maximum captive roll rate is 60 deg/sec. • Targets can be scored through station 9 only. • Two targets are not to be deployed or towed at the same time. ✱ Emergency Jettison airspeed range is 150 to 300 knots. ✱✱ Target launch or cable release.
C	NA	NA	NA	NA	NA	NA	NA	1 Mirror configurations authorized; fuel tanks may be flown on empty stations (1 or 9 and 5). 2 If visual augmenter accidently deploys (comes out of bag), the pilot should limit airspeed to 250 KCAS and adhere to target deployment/recovery limits; pilot can land with visual augmenter deployed. 3 Maximum altitude for carriage with target set stowed, in tow, or no target set is 40,000 feet. 4 Maximum roll rate with target set stowed or no target set is 60 degrees/second. 5 Maximum altitude for target set deployment/recovery is 25,000 feet; minimum altitude is 1,000 feet. 6 Maneuvering during target set deployment/recovery is limited to 15 deg/sec roll rate not to exceed 30 degrees bank; no maneuvering is authorized when the target set is within 100 feet of aircraft. 7 If visual augmenter becomes detached during towing, reduce airspeed below 300 KCAS. Target set recovery can be performed using minimum recovery limits, but should be done cautiously. 8 Do not exceed 60 deg/sec roll rate; 135 degrees bank angle; and/or 17 units AOA. 9 The tow reel may only be jettisoned with the cable/target set in-trail directly behind the tow reel. The cable/target set should not be yawed relative to the aircraft.
				+1.0 6	230 5	250		
				NA	NA	NA		

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Figure 5-10 (Sheet 21 of 23)

EXTERNAL STORES LIMITATIONS

MISCELLANEOUS AND SUSPENSION EQUIPMENT

STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON		
							AIRSPEED		ACCEL G				
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	MIN KNOTS	MAX KNOTS	
AN/ASQ-T-11, T-13, T-17, T-20, T-21, T-25 AIS Pod (ACMI System) GRDCUS Shooter Pod Maximum Load-4	Aero-3/B, LAU-105 Launcher with or without 3-inch spacers		●		●		✈	✈	✈ *	✈ *	NA	NA	
Empty MER	MAU-12	▽ ▽				▽ ▽	✈	✈	✈ *	✈ *	350	550	A
Maximum Load-3	℄ Adapter			▽ ▽							275	350	
Empty TER Maximum Load-2	MAU-12		▽		▽		✈	✈	✈ *	✈ *	175	550	B
Empty Aero-3/B or LAU-105 Launchers	MAU-12 with or without single or double 3-inch spacers		‡		‡		✈	✈	✈ *	✈ *	NA	NA	C
AN/AVQ -26 Pave Tack Pod Maximum Load – 1	Aero-27/A or BRU-5/A			●			550	0.9	+6.0 −2.0	+4.8 0.0	NA	NA	D
Pave Tack Adapter Maximum Load-1				—			✈	✈	✈	✈			
BLU-107/B DURANDAL	MER			⋈			600	0.95	+5.0 −1.0	+4.0 0.0	175	450	E
	TER		⋈		⋈							550	
RT-1210/AXQ-14 ADL Pod Maximum Load – 1	Aero-27/A or BRU-5/A			●			✈	✈	✈	✈	NA	NA	F
AN/AKQ-T1 Telemetry Pod Maximum Load-1	Aero-7A AIS Pod on R2393 rail of inboard station of station 2	MISSILE STATIONS 3		4	6	7	750	1.6	✈ *	*	NA	NA	G

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Figure 5-10 (Sheet 21A of 23)

MISCELLANEOUS AND SUSPENSION EQUIPMENT

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX	MIN	MAX	MAX	MIN	MAX		
	ACCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
A	NA	NA	NA	NA	NA	NA	NA	• If gross weight is over 37,500 lbs, refer to Acceleration Limitations Chart. • Maximum roll rate is 200 deg/sec. • AIM-9 or AIM-7 not authorized when confined with AIS Pod. However, captive AIM-9 with inert rocket motor and AIM-7 Simulator Plug are authorized. ✱ Stores compatability limit does not apply.
B	NA	NA	NA	NA	NA	NA	NA	• Maximum roll rate is aircraft limits. ✱ Stores compatability limit does not apply.
C	NA	NA	NA	NA	NA	NA	NA	• Maximum roll rate is aircraft limits. ✱ Stores compatability limit does not apply.

D	NA	NA	NA	NA	NA	NA	NA	• (STA 2/8): One or two empty Aero-3/B launchers and spacers may be carried in combination with any other certified stores subject to the following restrictions:
								  • Only one type of store in addition to the launchers permitted on each aircraft station and the flight limitations of the more restrictive of the two will be observed.
								  • Fit clearance of at least one inch must exist between the launchers and the other stores mounted on the station.
								• Maximum roll rate is aircraft limits.
								✱ Stores compatability limit does not apply.

E	NA	NA	NA	NA	NA	NA	NA	• If gross weight is over 37,000 lbs, refer to Acceleration Limitations Chart. • Maximum roll rate is 150 deg/sec (Adapter only is aircraft limits). • Other stores cleared for carriage in TO 1F-4E-1 may be carried on empty stations except carriage of AIM-7 missiles on stations 4 or 6 is not authorized (Does not apply to adapter only.) • DMAS equipped aircraft only.
F	NA	NA	NA	+1.0	175	600	+5° to −5°	• If gross weight is over 45,000 lbs. refer to Acceleration Limitations Chart. • Minimum intervalometer settings: MER = 0.140 sec Ripple Single MER = 0.100 sec Ripple Single and Ripple Pairs • Simultaneous release from TER and centerline MER is prohibited. • To allow sufficient clearance between tandom bombs or MER, the aft set of lug wells must be used on front bombs and the nose caps must be removed from the aft bombs (forward set of lug wells). • For TER carriage, the aft set of lug wells must be used.
G	NA	NA	NA	NA	NA	NA	NA	• DMAS equipped aircraft.
	NA	NA	NA	NA	NA	NA	NA	• Mirror image is not authorized. • (STA 3): Pod with simulator module (SM-862) and Missile Gone switch. • Caps on stations 4, 6 and 7. • Maximum roll rate is 200 deg/sec. • Only AIS pods with aft handle shortened are authorized for carriage on R2393 rail. • AIM-9 or AIM-7 are not authorized when confined with pod. However, captive AIM-9 with inert rocket motor and AIM-7 Simulator Plug are authorized. ✱ Stores compatability limit does not apply.

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Figure 5-10 (Sheet 21B of 23)

EXTERNAL STORES LIMITATIONS

MISCELLANEOUS AND GUIDED BOMBS

STORE	SUSPENSION	STATION LOADING 1	2	5	8	9	CARRIAGE AIRSPEED KNOTS	MACH	ACCEL G SYM	UNSYM	JETTISON 1G LEVEL FLIGHT JETTISON MIN KNOTS	MAX KNOTS
		MISSILE STATIONS	3	4	6	7						
AN/AVQ-23 Pave Spike Pod Maximum Load – 1	Missile Well Adapter	FWD		●			550	1.2	+6.0 −1.0	+4.0 0.0	NA	NA
							600 *	1.2 *	+3.0 0.0	+2.4 0.0		
CTU-2/A Supply Container Maximum Load – 3	MER (Fwd)	▽ ●▽				▽ ▽●	400	0.95	+5.0 −1.0	+4.0 0.0	NA	NA
				●▽ ▽ *								
GBU-10/B, A/B, C/B D/B, E/B (MK-84 LGB) Maximum Load – 4	MAU-12	●	●		●	●	550	0.95	+5.0 −1.0	+4.0 0.0	175	650
							650	1.4	+3.0 0.0	+2.4 0.0		
GBU-10G/B H/B, J/B (BLU-109 with GBU-10 Airfoil group) Maximum Load-4	MAU-12	●	●		●	●	550	0.95	+5.0 −1.0	+4.0 0.0	175	600
							600	0.98	+3.0 0.0	+2.4 0.0		
GBU-11A/B (M118 LGB) Maximum Load – 2	MAU-12		●		●		550	0.95	+4.0 −1.0	+3.0 0.0	200	550
GBU-12/B, A/B, B/B, C/B, D/B (MK-82 LGB) High and Low Speed BDU-50A/B Maximum Load – 4	MAU-12	●	●		●	●	550	1.1	+5.0 −1.0	+4.0 0.0	175	550
GBU-12B/B, C/B, D/B BDU-50A/B Maximum Load –6	TER		●▽●		●▽●							
GBU-15(V)1/B Long Cord Wing Maximum Load – 2	MAU-12		●		●		650	1.4	+5.0 −1.0	+4.0 0.0	175	650
GBU-15 IR/DL Short Cord Wing GBU-15 TV/DL (MK-84)							600				150	600

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Figure 5-10 (Sheet 22 of 23)

MISCELLANEOUS AND GUIDED BOMBS

	EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
	MAX ACCEL G	MIN KNOTS	MAX KNOTS	MAX ACCEL G	MIN KNOTS	MAX KNOTS		
	NA	NA	NA	NA	NA	NA	NA	• If gross weight is over 37,000 lbs, refer to Acceleration Limitations Chart. • Rocket launchers not authorized on STA 5 when Pave Spike is loaded. • Maximum roll rate with visor open is 120 deg/sec. below 550 KIAS and 90 deg/sec. above 550 KIAS. * WITH VISOR CLOSED – airspeeds and roll rates are aircraft limits.
A	NA	NA	NA	+1.0	300	400	Level	* Either forward MER Shoulder may be used • Roll rate limit is 150 deg/sec. • Release 300 feet AGL or higher for chute function. • Only 8 inch fins are to be used.
B	NA	NA	NA	+4.0	175	550	+45° to -45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Extended wing version of bomb will not fit on stations 1 and 9 pylon due to interference between bomb wing and aircraft wing. • Landing with 2 bombs on the same wing is not recommended because the asymmetric moment exceeds that of one full external wing tank. • Weight and balance of each aircraft loaded with one or two Guided Bombs must be examined for CG location during all possible takeoff and landing conditions.
				+3.0	175	650		
C	NA	NA	NA	+4.0	175	550	+45° to -45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • Landing with 2 bombs on the same wing is not recommended because the asymmetric moment exceeds that of one full external wing tank. • Weight and balance of each aircraft loaded with one or more Guided Bombs must be examined for CG location during all possible takeoff and landing conditions.
				+3.0	175	600		
D	NA	NA	NA	+1.0	200	550	Level to -45°	• Weight and balance of each aircraft loaded with one or two Guided Bombs must be examined for CG location during all possible takeoff and landing conditions. • Landing with one M118 LGB should be avoided. One M118 LGB on an inboard pylon may exceed forward CG limit at landing gross weight; aircraft roll attitude during landing should be maintained within plus or minus one degree, and the maximum recommended sink rate is 8 feet per second. • Roll rate limit is 90 deg/sec.
E	NA	NA	NA	+5.0	175	550	+45° to -45°	• If gross weight is over 45,000 lbs refer to Accelerations Limitations Chart.
F	NA	NA	NA	+2.0	175	650	+6° to -35°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • DMAS equipped aircraft. • For Asymmetric carriage, refer to Section VI, Flight with Asymmetric Loading, Subsonic and Supersonic maneuvering. • Weight and balance of each aircraft loaded with one or more Guided Bombs must be examined for CG location during all possible takeoff and landing conditions. • Maximum jettison and release limit is 1.0 Mach.
				+3.0	175	575		
				+0.5 +1.5		600	+10° to -45°	

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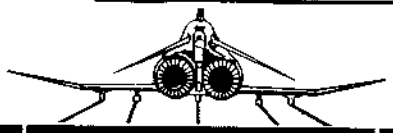
Figure 5-10 (Sheet 23 of 23)

EXTERNAL STORES LIMITATIONS

GUIDED BOMBS



STORE	SUSPENSION	STATION LOADING					CARRIAGE				JETTISON 1G LEVEL FLIGHT JETTISON	
							AIRSPEED		ACCEL G		MIN	MAX
		1	2	5	8	9	KNOTS	MACH	SYM.	UNSYM.	KNOTS	KNOTS
GBU-24/B (MK-84), A/B (BLU-109) Maximum Load -4	MAU-12		●		●		600	1.1	+5.0 -1.0	+4.0 0.0	175	600
		●				●	550					
							600	1.1	+4.0 0.0	+3.0 0.0		

4E-1-(91-23.1153

Figure 5-10 (Sheet 23A of 23)

GUIDED BOMBS

EMPLOYMENT			RELEASE			DELIVERY ANGLE	REMARKS
MAX	MIN	MAX	MAX	MIN	MAX		
AGCEL G	KNOTS	KNOTS	ACCEL G	KNOTS	KNOTS		
NA	NA	NA	+4.0	175	600	+30° to −45°	• If gross weight is over 45,000 lbs, refer to Acceleration Limitations Chart. • For asymmetric carriage, refer to Section VI, Flight with Asymmetric Loading Subsonic and Supersonic Maneuvering. • Weight and balance of each aircraft loaded with one or two Guided Bombs must be examined for CG location during all possible takeoff and landing conditions.
					550		
			+3.0	175	600		

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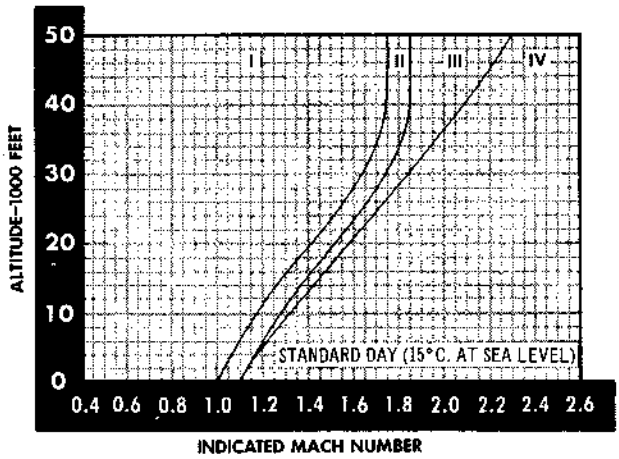
Figure 5-10 (Sheet 23B of 23)

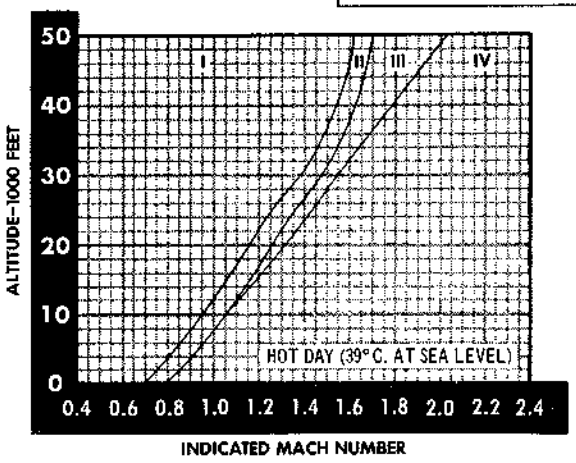
AIM-9 AIRSPEED LIMITATIONS

MK 8 MOD 0/1/2 WARHEAD ONLY

Note

THE MK 8 MOD 3 WARHEAD IS UNRESTRICTED.





ZONE I – NO RESTRICTIONS.

ZONE II – REPEATED EXCURSIONS OF NO MORE THAN 10 MINUTES EACH ARE PERMITTED.

ZONE III – REPEATED EXCURSIONS OF NO MORE THAN 5 MINUTES EACH ARE PERMITTED. INSPECTION OF WARHEADS IS RECOMMENDED AFTER EACH FLIGHT INVOLVING EXCURSIONS INTO ZONES II AND III.

ZONE IV AVOID.

IF LIMITATIONS OF ZONES II, III, AND IV ARE VIOLATED THE WARHEAD SHOULD BE DESTROYED BY JETTISONING THE MISSILE IF POSSIBLE. LANDINGS CAN BE MADE WITH LOW ORDER RISK IF JETTISONING IS NOT POSSIBLE.

THESE LIMITATIONS DO NOT APPLY TO AIRCRAFT CLIMB SCHEDULES, INCLUDING MAXIMUM PERFORMANCE.

4E-1-(33)C

Figure 5-11

required.

Landing

Landing with asymmetric loads equivalent to one full external wing tank can be made. Recommended techniques are essentially the same as for crosswind operation. A straight-in pattern avoiding abrupt or accelerated maneuvers is recommended. To determine approach speed and AOA, establish the landing configuration and slow to a speed at which full aileron trim will hold wings level. This should result in 16 to 17 units AOA for an asymmetric load equivalent to one full external wing tank. A check for roll capability by applying additional aileron to pick up the heavy wing should be made. This AOA should be maintained during the approach and touchdown. An abrupt flare will cause a strong roll into the heavy wing. During landing roll, the aircraft may turn away from the heavy wing as brakes are applied. This can be controlled by rudder and nose gear steering.

Go-Around

If a go-around is necessary from an established final, abrupt stick movement should be avoided. Power should be advanced to military and the nose smoothly raised to the desired attitude. When no longer in a descent, the gear may be retracted; however, flap retraction should be delayed until at least 200 knots has been attained. Rudder and afterburner may be required to maintain wings level flight.

Maneuvering

During any maneuvering with asymmetric stores, expect a degradation of normal control response. This is most apparent at low subsonic or high supersonic speeds. Roll tendency increases significantly with increased G loading, especially for large load asymmetries. At some airspeeds/Mach numbers, roll authority with both aileron and rudder may be insufficient to counter the rolling moment developed by increased G load and an asymmetric store.

Use smooth control inputs when flying with an asymmetric load. With asymmetry equivalent to one full wing tank (maximum allowable) do not exceed 16 units AOA. Normal stall warning cues may be absent when maneuvering with an asymmetric load. At the first indication of a departure, immediately reduce AOA. If a departure occurs, spin entry is highly probable.

SUBSONIC MANEUVERING

Aircraft response with asymmetric stores at low subsonic speed and high G loading is characterized by a failure to respond in roll. This is caused by coupling of excessive aileron drag (adverse yaw) and an inability of the ailerons and spoilers to overcome the additional weight and momentum of an asymmetric load. In some flight conditions (low speed with large asymmetric load) it is possible to exceed the aerodynamic roll authority of the aircraft and a rapid departure will result. Departure may occur at an airspeed well above and an AOA well below the onset of normal buffet and stall cues. At the first indication of a deterioration of roll authority, reduce AOA and increase airspeed.

At high subsonic airspeed, high G loading and large asymmetry, the only way to regain control of the aircraft once the roll has developed is to reduce the G loading thereby regaining aircraft roll authority over the asymmetric load. The maximum aircraft roll authority is attained at zero G.

SUPERSONIC MANEUVERING

At supersonic speed, roll control decreases with increasing Mach number. Roll authority is a function of Mach, dynamic pressure, aileron authority, asymmetric moment and store drag. Supersonic flight may result in inadequate roll authority to maintain wings level with an asymmetric load. As G is increased, aileron authority will decrease until the aircraft rolls off toward the store. The roll off will occur abruptly if G onset is rapid. If total loss of roll authority occurs with an asymmetric load at supersonic speed, reduce power, extend speed brakes, and unload as necessary to regain roll authority. Maximum roll authority is achieved at zero G. Since the rudder is ineffective in producing roll above 1.1 Mach, ailerons should be used to roll the aircraft above this speed. Extreme caution must be used in the transonic region. The abrupt increase in G loading experienced in the transition from supersonic to subsonic speed can lead to further degradation in roll authority and possible departure.

WARNING

For recovery from loss of roll authority at supersonic speed, reduce power, extend speed brakes, and perform an unloaded roll to the nearest horizon. When wings level, smoothly apply back stick to help decrease airspeed and minimize altitude loss. As speed decreases, additional roll authority will be available and G can be increased. Aileron into the heavy wing can result in an extremely high rate self-sustaining roll from which recovery may be impossible.

FLIGHT WITH ASYMMETRIC SLATS

Asymmetric slats produce roll, and therefore limit maneuvering capability. Roll-off is first experienced at 14 units AOA, and full cross-controls will be required to maintain straight and level flight when reaching 19 units AOA. A symmetrical slat configuration (extended or retracted) is necessary for combat maneuvering.

STALLS

A stall, as discussed in the Flight Manual, is defined as a breakdown in directional stability (i.e., nose slicing). Characteristics normally experienced while approaching a stall include buffet onset, nose rise, and wing rock. These characteristics and the violence of the stall itself are dependent upon the external loading, CG location, and control technique. They are not entirely predictable or repeatable.

WARNING

The pilot should not depend upon wing rock, buffet, directional instability (nose slice), or any classic characteristics for a stall warning. In any configuration or loading, and especially with moderately high pitch change rates, it is possible to increase AOA above 30 units without wing rock or directional instability, at which time loss of control may result.

NOTE

Refer to section I for rudder pedal shaker and AOA aural tone operation.

CRUISE/COMBAT CONFIGURATION

1 G Stalls

Conventional stalls do not normally occur until well above 30 units AOA. Departures and/or engine stall/flameout can occur above 30 units AOA. Buffet is mild, and wing–rock will not normally occur below 30 units AOA. Pitch control is positive, and the AOA can be easily reduced by forward stick movement. Recovery, if initiated rapidly, is effected by positioning the stick forward (3–8 units AOA) and advancing the throttles to military power while maintaining ailerons and rudder neutral. Altitude loss can be minimized by applying maximum power, easing the stick forward momentarily to attain 21 to 25 units AOA, then stabilize AOA at 25 units. Also refer to Stall Characteristics chart (figure 6–4).

Roll Coupling

The F-4E, like all aircraft with a high fuselage loading design, is susceptible to roll coupling. This is a flight phenomenon where inertia and adverse aerodynamic effects of roll, pitch, or yaw can combine to exceed the stabilizing forces on the aircraft and cause divergence about one or all of these axes. A common method of encountering roll coupling is performing continuous full stick deflection aileron rolls. While rolling rapidly, the aircraft diverges slightly from roll about the longitudinal axis. If the roll is continued, forces can build which may cause the aircraft to rapidly transititon to movement around the vertical axis. Because there is a high probability that roll coupling will occur under the above conditions; full deflection aileron rolls exceeding 360° are prohibited. The higher the AOA during the roll, the quicker the aircraft can be adversely affected by roll coupling. It is possible to aggravate the effects of roll coupling by adding pitch and yaw inputs to the aircraft while rolling rapidly. Under certain conditions this can cause the aircraft to depart without stall warning. Aircraft susceptibility to roll coupling is increased with aft center of gravity, with centerline stores loaded, and with absence of wing mounted stores. Out–of–Control Recovery procedures in Section 3 should be used to recover if the aircraft departs under these conditions.

Accelerated Stalls

Accelerated stalls produce only mild to moderate buffet. Wing-rock normally does not occur below 25 units AOA, and often does not occur until reaching 28–30 units AOA. Departures which occur above 30 units tend to be gentle, and are predominantly roll rather than yaw. Normal recoveries are positive. Prompt neutralization of controls will generally effect recovery from accelerated stall approaches. Control of angle of attack with stick position is of paramount importance to effect recovery from the stall. Oscillations in roll and yaw which may be present during recovery should be allowed to damp themselves out and should not be countered with aileron or rudder.

WARNING

- The use of aileron or excessive rudder when approaching either a 1 G or accelerated stall condition will produce yaw and increase AOA. This increases the probability of loss of control. Left stick produces a right yaw, and right stick produces a left yaw.
- If slats are not programming properly, 25 units AOA will result in an immediate departure. If slats do not extend or buffet occurs below 19 units AOA, do not exceed 19.2 units AOA.

Negative G Stalls

A negative G (inverted) stall can be entered with abrupt application of forward stick and is indicated by 0 AOA. Light to moderate buffet will occur at the stall and there are no distinct yaw or roll tendencies. Recovery from the negative G stall is effected by relaxing the forward stick pressure and maintaining AOA between 3 to 8 units until recovered.

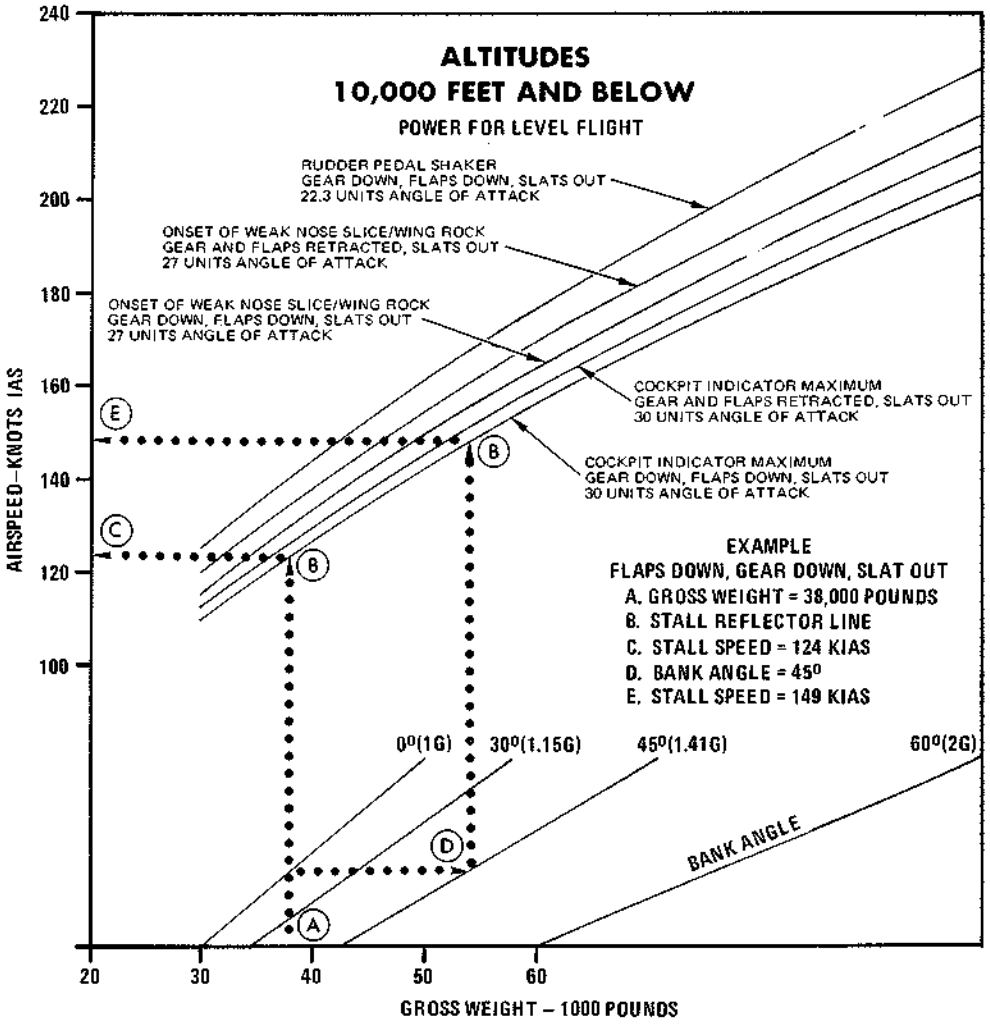
Landing Configuration Stalls

Stall approaches in the landing configuration are safe, with satisfactory control about all axes up to 26 to 28 units angle of attack. In the landing configuration, the aircraft will generally stall at higher AOA than in the cruise configuration. Above 26 units AOA, the increase in stick forces serves to reduce the potential for inadvertent stalls. Approaching the stall, the airplane exhibits a slight nose rise (a reduction in the stick force required to hold pitch attitude). The magnitude of this stick force lightening is a function of the center of gravity position (aft CG gives lighter forces). Stick force lightening occurs between 23 and 25 units AOA. Wing rock usually increases in intensity as angle of attack is increased, but seldom exceeds $\pm 40°$ bank angle at the stall. If bank angles in excess of $\pm 30°$ or nose slicing are experienced, the stall approach should be discontinued. Moderate buffet and wing rock will occur above 26 to 28 units AOA. Recovery is effected by advancing the throttles to MAX AB and placing the stick forward to attain and maintain ON SPEED AOA. If altitude is critical, 21 to 25 units AOA will result in minimum altitude loss.

WARNING

Do not depend on the wing rock or buffet for natural stall warning. In any configuration or loading, it is possible to exceed 30 units AOA without any wing rock or buffet, at which time loss of control may result. Loss of at least 3000 feet altitude should be anticipated.

STALL CHARACTERISTICS



4E–1–(68)A

Figure 6-4

shut down. An aircraft flight should not be aborted for failure of a generator to come on or stay on the line prior to engine/oil warm-up nor should an abort be declared if an engine shut-down and restart will bring and keep a generator on the line. Starts using alternate fuels (JP-5, JP-8, JET A, or JET A-1) will require longer to accelerate to idle rpm. The degradation in acceleration time becomes progressively more pronounced as temperature decreases. Starts at sub-zero temperatures using kerosene base fuels may require up to 75 seconds longer than with JP-4. Rpm increase after light-off may be particularly slow when making cartridge mode starts. Starts should not be discontinued prematurely due to slow acceleration or temporary rpm stagnation. Temporary stagnation at settings below idle rpm is acceptable for periods up to 30 seconds provided permissible EGT limits are not exceeded.

CAUTION

Ensure that GEN OUT and BUS TIE OPEN lights go out. The maximum amount of time that the engine can run at 100 psi oil pressure before discontinuing the start is 2 minutes when the temperature is below −18°C (0°F) and 4 minutes when the temperature is below −35°C.

NOTE

In extremely cold weather, the throttle linkage is very stiff and both hands may be required to move the throttles out of the OFF position.

WARM-UP AND GROUND CHECK

When checking the flight controls, lateral stick movement will be extremely stiff. Slowly cycle the control stick until full lateral stick throw is available. Repeated control cycling will alleviate the stiffness somewhat, but normal system feel may not return until after approximately 1 hour of system operation. Before takeoff, assure all instruments are allowed an adequate warm-up period and are operating normally.

CAUTION

- During engine ground operation when icing conditions are present, rapid throttle movement with possible ice accumulation in the compressor could result in a stall. Do not operate below 82% rpm for more than 5 minutes. Operate at MIL for at least 30 seconds for each period below 82% rpm.
- Cold weather operation (below 40°F) contributes to AVTR head clogging. Before engine start load cassette leaving cassette door open allowing cockpit heaters to heat AVTR. Turn AVTR to STBY. Close AVTR door prior to take off.

TAXIING

Avoid taxiing in deep or rutted snow since frozen brakes will likely result. Also, increase space between aircraft while taxiing at sub-freezing temperatures, to insure safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice blown by the jet blast of a preceding aircraft.

BEFORE TAKEOFF

The thrust developed by the engine in low temperature is noticeably greater and brake demands will be greater to hold position; however, when operating with maximum engine compressor bleed air (cockpit pressurized) in outside air temperatures of −37°C and below, rapid throttle bursts may result in an rpm hang-up. If engine icing conditions are anticipated, place the engine anti-ice switch in the DE-ICE position and place the pitot heat switch ON.

NOTE

When operating under extremely low temperatures (approximately −40°C or below), RPM hang-up, cyclic afterburner operation, or engine flameout may be experienced.

TAKEOFF

NOTE

- When operating from runways which are covered with excessive water, snow or slush, high-speed aborts may result in engine flame-out due to precipitation ingestion. The probability of flame-out is highest when throttles are chopped from afterburner to IDLE at speeds above 100 knots. With a double flame-out, normal braking, anti-skid protection, and nose gear steering will be lost. After takeoff from runways covered with snow or slush, packed snow/slush in the auxiliary air door area may make throttle movement difficult until the snow/slush can be melted.
- If inflight freezing within the longitudinal control system is experienced, excessive stick forces may be required to move the control stick. Normal airplane control is available but requires higher initial force inputs. Normal control forces should return at lower (warmer) altitudes.

AFTER LANDING

When wearing bulky arctic survival clothing and winter flying gloves, rapid egress from the cockpit by disconnecting the torso harness will be impeded due to the inability to see the connectors and by a degraded sense of touch. During operations where the temperature is below freezing with heavy rain, or expected to drop below freezing with heavy rain, the aircraft should be parked with wings spread.

BEFORE LEAVING AIRCRAFT

Leave canopy open, unless weather prevents, to permit circulation. This helps prevent canopy cracking from differential cooling and decreases windshield and canopy frosting. Also check that all protective covers are installed.

HOT WEATHER PROCEDURES

CAUTION

Do not attempt takeoff or engine operation in a sand storm or dust storm, if avoidable. Park aircraft crosswind and shut down engine to prevent sand or dirt from damaging engine.

TURBULENCE AND THUNDERSTORMS

WARNING

The following factors, singly or in combination, could cause engine flame–outs:

- Penetration of cumulus build–ups with associated high moisture content.
- Engine icing of either nose cowl or inlet guide vanes.
- Turbulence associated with penetration can result in extreme angles of attack which may cause marginal engine performance.
- Above 40,000 feet, the surge margin of the engine is reduced and there is poor air distribution across the face of the compressor.
- In view of the above, the pilot should avoid areas of turbulent air, hail storms, or thunderstorms, whenever possible, because of the increased danger of engine flame–out. If these areas cannot be avoided, the engine anti–icing system should be turned on prior to weather penetration. EGT gages should be monitored continuously during weather penetration. A rise of EGT is an indication of engine icing. The engine anti–icing systems prevent the formation of ice and is not a de–icer. Whenever possible, icing conditions should be anticipated in advance and the anti–icing system should be turned on to warm up the engine air inlet.

PENETRATION

The aircraft is exceptionally stable and comparatively easy to control in the severe turbulence; however, the effects of turbulence becomes noticeably more abrupt and uncomfortable at airspeeds above optimum cruise and below 35,000 feet. The aircraft is not displaced significantly from the intended flight path and desired heading. Attitude can be maintained with reasonable accuracy.

PENETRATION AIRSPEED

The optimum thunderstorm penetration speed is 300 knots. Afterburner may be necessary to maintain this airspeed above 35,000 feet.

NOTE

Optimum thunderstorm penetration airspeed is a compromise between pilot comfort, controllability, structural stress (due to gust loads and impact precipitation), and engine inlet air distortion. At high airspeeds, aircrew discomfort and structural stress are greater. At slow speeds, controllability is somewhat sacrificed and inlet airflow distortion (due to turbulence) may induce compressor stalls and/or engine flameout.

APPROACHING THE STORM

If storm cannot be seen, it may be located by use of radar. Establish the recommended penetration airspeed and perform or check the following:

1. Adjust throttle to maintain desired penetration speed.
2. Pitot heat switch – CHECK ON
3. Engine anti–icing switch – DE–ICE
4. Autopilot – OFF
5. Lower seat
6. Inertia reel – MANUALLY LOCK

If night penetration –

7. White floodlights – ON
8. Instrument lights – FULL BRIGHT
9. Console lights – FULL BRIGHT

CAUTION

Do not try to top thunderstorms at subsonic speeds above 40,000 feet. The stall margin of both the airframe and engines becomes critical in this region. Flight through a thunderstorm at the proper airspeeds is much more advantageous than floundering into the storm at a dangerously

F-4E

AIRPLANE LOADING

WARNING

FOR PRECISE AIRPLANE BASIC WEIGHT, EXTERNAL STORE AND ATTACHMENT INFORMATION, REFER TO CHARTS C AND E OF THE WEIGHT AND BALANCE DATA HANDBOOK (TO 1-1B-40) FOR THE PARTICULAR AIRPLANE.

SUSPENSION EQUIPMENT	WEIGHT PER STATION	DRAG PER STATION	STABILITY INDEX NUMBER
CENTERLINE MER ADAPTER AND SWAYBRACE ADAPTERS	71	3.9	N A
CENTERLINE MER WITH ADAPTER	270	10.0	N A
INBOARD ARMAMENT PYLON	264	2.6	6.9
INBOARD ARMAMENT PYLON AND TER	359	6.8	13.5
INBOARD ARMAMENT PYLON AND TWO AERO-3B OR LAU-105 MISSILE LAUNCHERS	374	3.4	9.1
INBOARD ARMAMENT PYLON AND LAU-34/A MISSILE LAUNCHER	350	4.0	9.3
INBOARD ARMAMENT PYLON AND LAU-88/A, A/A LAUNCHER	740	13.7	21.5
INBOARD ARMAMENT PYLON AND LAU-117 LAUNCHER	399	9.6	13.9
INBOARD ARMAMENT PYLON AND LAU-118 LAUNCHER	367	5.0	10.0
SPECIAL WEAPONS ADAPTER	66	1.6	1.6
OUTBOARD ARMAMENT PYLON	190	2.1	4.3
OUTBOARD ARMAMENT PYLON AND OUTBOARD MER	410	10.1	11.4
OUTBOARD ARMAMENT PYLON AND LAU-34/A MISSILE LAUNCHER	276	3.4	6.8
PAVE TACK ADAPTER	78	1.5	N A

Notes ● ARMAMENT PYLON WEIGHTS ARE BASED ON MAU-12B/A. FOR MAU-12C/A, ADD 9 POUNDS.

4E-1-(298-1)53

Figure A1-1 (Sheet 1 of 4)

F-4E STORE	WEIGHT PER STORE (POUNDS)	DRAG PER STORE	UNIT STABILITY NUMBER	
			SINGLE MOUNTED	CLUSTER MOUNTED
WING TANK AND PYLON	F-2713 E-308	6.4	SEE BELOW	
WITHOUT INBOARD STORES OR PYLONS			20.0	NA
WITH INBOARD STORE AND/OR PYLON			30.0	NA
WITH INBOARD LAU-88 LAUNCHER			46.5	NA
600 GAL HIGH PERFORMANCE CENTERLINE TANK	F-4244 E-338	9.6	NA	NA
ROYAL JET 600-GAL EXT TANK	F-4200 E-300	9.6	NA	NA
A/A 37U-15 TOW TARGET SYSTEM (WITH CABLE AND TARGET)	674(983)	14.3(45.6)	7.0	NA
A/A 37U-33 AERIAL GUNNERY TARGET SYSTEM				
• AN/RMK-33/A TOWING SET	357	5.0	8.0	NA
W/TARGET DEPLOYED		NE	NE	NA
• AN/TDK-36/A TARGET SET	107	2.0	3.0	NA
A/A 37U-36 (WT: FULL/LESS TGT/LESS TGT and CABLE)	902/745/495	21 (STOWED) 42 (TOWED)	8.0 (STOWED OR IN TOW)	NA
AGM-45 OR ATM-45 TRAINING MISSILE	395	2.3	2.7	N A
AGM-65 OR TGM-65 TRAINING MISSILE	464	2.8	17.6	23.5
AIM-7E, AND AIM-7E WITH AN/AWM-19;-7F MISSILE	435, 510	1.3	NA	N A
AIM-9 (BASIC, -1 CONFIGURATION) MISSILE	166	1.3	1.0	1.4
AIM-9 (-2, -3 CONFIGURATION) MISSILE	178	1.3	1.0	1.4
AN/ASQ-T-13	160	1.3	1.0	NA
ALE-38 CHAFF DISPENSER	F-470 E-212	4.0	21.0	NA
ALE-40 DISPENSER (MASTER AND SLAVE)	F-67 E-45	2.8	0	NA
ALQ-101(V)-10	540 *	WING-2.0 FUS-1.3	5.0	NA
ALQ-119(V)-15, (V)-17	580.406 *	WING-2.5 FUS-1.7	12.2	NA
ALQ-131(V)-4, -5, -6	659 *	WING-4.5 FUS-5.8	35.0	NA
ALQ-131(V)-9, -10	559 *	WING-4.5 FUS-5.8	35.0	NA
ALQ-131(V)-13	574 *	WING-4.5 FUS-5.8	35.0	NA
ALQ-131(V)-12, -14	674/714	WING-4.5 FUS-5.8	35.0	NA
ALQ-131(V)-15	615	WING-4.5 FUS-5.8	35.0	NA
ALQ-176	247	WING-2.0 FUS-1.3	4.4	NA
ALQ-184(V) -1, -2	641/474 *	WING-2.5 FUS-1.7	12.2	NA
ALQ-188	300	4.0	4.1	NA
AN/ASQ T-17, -20, -21, -25	122	1.3	1.0	NA

F – FULL
E – EMPTY
NA – NOT APPLICABLE
NE – NOT ESTABLISHED

* FOR FUSELAGE MOUNTED PODS, ADD 57 POUNDS FOR ADAPTER.

4E-1-(298-2)53

Figure A1-1 (Sheet 2 of 4)

F-4E STORE		WEIGHT PER STORE (LBS)	DRAG PER STORE	UNIT STABILITY NUMBER	
				SINGLE MOUNTED	CLUSTER MOUNTED
QRC 80-01(V)-3, -4		595/435 *	WING-2.5 FUS-1.7	12.2	NA
B43 SPECIAL STORE WITH MOD 0 NOSE/BDU-8(SHORT NOSE) PRACT. BMB		2060	4.1	9.2	NA
B43 SPECIAL STORE WITH MOD 1 NOSE/BDU-8 (LONG NOSE) PRACT. BMB		2135	4.1	9.2	NA
B57 SPECIAL STORE/BDU-12 PRACTICE BOMB		510	2.2	4.9	NA
B61 SPECIAL STORE/BDU-38 PRACTICE BOMB		716	2.2	2.5	NA
BDU-33 PRACTICE BOMB		23	0.2	0.6	0.8
BLU-52 BOMB		360	3.8	10.7	14.3
BLU-107/B (DURANDAL)		480	1.1	2.8	3.7
BLU-109 WITH MK-84 CONICAL FIN		2020	3.4	7.2	NA
BL-755 BOMB		610	4.4	7.8	10.4
CBU-7 DISPENSER (UNFINNED)		F-822 E-188	F-4.4 E-6.9	13.0	13.0
CBU-12/A, A/A DISPENSER		650, 657	3.3	10.0	13.0
CBU-24 DISPENSER		820	4.2	7.4	9.9
CBU-30 DISPENSER (UNFINNED)		F-385 E-188	F-4.4 E-6.9	13.0	13.0
CBU-38 DISPENSER (UNFINNED)		F-704 E-188	F-4.4 E-6.9	13.0	13.0
CBU-46 DISPENSER		F-886 E-165	3.3	10.0	13.3
CBU-49 DISPENSER		839	4.6	7.4	9.9
CBU-52 DISPENSER		785	4.6	7.4	9.9
CBU-58, -71 DISPENSER		800	4.6	7.4	9.9
CBU-87/B		960	5.0	8.0	10.0
CBU-89/B GATOR MINE		680	5.0	8.0	10.0
COMBAT DOCUMENTATION CAMERAS		16	3.7 (PAIR)	NA	NA
GBU-10 (MK-84) LASER GUIDED BOMB		2052	6.3	26.2	NA
GBU-10 (BLU-109)		2081	6.3	26.2	NA
GBU-11 (M118 LASER GUIDED BOMB)		3066	8.2	54.0	NA
GBU-12B, A/B, (MK-82 LASER GUIDED BOMB) OR BDU-50A/B PRACTICE BOMB	HIGH SPEED FIN	620	2.3	9.4	NA
	LOW SPEED FIN		3.1		
GBU-12B/B, C/B, D/B (MK-82LGB) OR BDU-50A/B PRACTICE BOMB		620	2.0	4.5	6.0
GBU-15(V)1/B		2515	10.0	55.0	NA
GBU-15 IR SHORT CORD WING (MK-84)		2472	10.0	55.0	NA
GBU-15 TV SHORT CORD WING (MK-84)		2426	10.0	55.0	NA
GBU-24/B, A/B LOW LEVEL LGB		2306	6.3	26.2	N A
GRDCUS (SHOOTER POD)		126	1.3	1.0	NA
AN/AXQ-14 AIRCRAFT DATA LINK POD		435	3.4	NA	NA
LAU-3/A ROCKET POD	WITH NOSE AND TAIL CONE	495	4.1	10.1	13.5
	WITHOUT NOSE AND TAIL CONE (EMPTY)	70	5.8	10.1	13.5
LAU-68 ROCKET POD	WITH NOSE AND TAIL CONE	191	1.6	3.9	5.2
	WITHOUT NOSE AND TAIL CONE (EMPTY)	67	2.5	3.9	5.2
LAU-131 ROCKET POD	WITH NOSE CONE	226	1.6	3.9	5.2
	WITHOUT NOSE CONE (EMPTY)	68	2.5	3.9	5.2

F – FULL
E – EMPTY
NA – NOT APPLICABLE
NE – NOT ESTABLISHED

4E-1-(298-3)53

Figure A1-1 (Sheet 3 of 4)

F-4E

STORE		WEIGHT PER STORE (POUNDS)	DRAG PER STORE	UNIT STABILITY NUMBER	
				SINGLE MOUNTED	CLUSTER MOUNTED
M36E2 INCENDIARY CLUSTER BOMB		F-929 E-880	4.7	8.4	11.2
M117 GENERAL PURPOSE BOMB WITH MAU-103A/B FIN		812	3.2	7.5	10.0
M117R (RETARDED) GENERAL PURPOSE BOMB OR M117D (DESTRUCTOR)		880	4.2	7.5	10.0
M118 GENERAL PURPOSE BOMB		3020	10.1	N A	N A
M129E1, M129E2 LEAFLET BOMB/MJU-1 CHAFF BOMB		206/305	3.0	7.3	9.7
MATRA 250 KG BOMB (UNRETARDED)		FR-545 GER-523	4.4	4.2	5.5
MC-1 GAS BOMB		740	3.0	7.3	9.7
MK-20 ROCKEYE II		490	2.9	7.2	9.6
MK-36 DESTRUCTOR		550	2.4	2.8	3.7
MK-81 GENERAL PURPOSE BOMB		270	0.8	1.8	2.4
MK-82 GENERAL PURPOSE BOMB OR BDU-50/B, A/B PRACTICE BOMB		510	1.1	2.8	3.7
MK-82 SNAKEYE 1 BOMB		550	2.4	2.8	3.7
MK-82/BSU-49/B (AIR INFLATABLE RETARDER)		528	1.1	2.8	3.7
MK-83 GENERAL PURPOSE BOMB		985	1.8	4.6	6.1
MK-84 GENERAL PURPOSE BOMB		1970	3.4	7.2	N A
MK-84/BSU-50/B (AIR INFLATABLE RETARDER)		2008	3.4	7.2	N A
MXU-648 CARGO PODS	REMOVABLE TAILCONE	E-130 *	3.4	14.0	N A
	FIXED TAILCONE	E-98 *			
NOSE GUN AMMO (639 ROUNDS PRIOR TO FIRING/AFTER FIRING)		373/169	N A	N A	N A
PAVE SPIKE POD (AN/AVQ-23)		479 **	1.3	N A	N A
PAVE TACK POD (AN/AVQ-26)		1217	28.5	N A	N A
PAVE TACK ADAPTER		78	1.5	N A	N A
RMK-19 REEL LAUNCHER WITH TDU-22 TARGET & TOW CABLE (TARGET DEPLOYED)		1866 E-850	15.0 (30.0) ESTIMATED	NA	NA
SUU-16 GUN POD (50 ROUNDS AMMO)/(FULLY LOADED)		1043/1693	8.1	26.4	N A
SUU-20/A, A/A, A/M, B/A PRACTICE BOMB AND ROCKET DISPENSER W/SIX BDU-33		F-378, 468, 468, 414 E-240, 330, 330, 276	F-3.1 E-3.7	12.3	N A
SUU-21 PRACTICE BOMB DISPENSER WITH SIX BDU-33		F-598 E-460	3.3	11.8	N A
SUU-21 PRACTICE BOMB DISPENSER WITH SIX MK-106		F-490 E-460	3.3	11.8	N A
SUU-23 GUN POD (50 ROUNDS AMMO)/(FULLY LOADED)		1072/1722	8.1	26.4	N A
GPU-5/A GUN POD (FULL) (EMPTY) (FIRED OUT)		1865/1273/1393	9.7	N A	N A
SUU-25 B/A, C/A, E/A FLARE DISPENSER		E-161, 264, 264 F-401, 504, 504	4.0	8.0	10.6
TISEO SCOPE HOUSING (LEFT WING)		NE	5.8	N A	N A
TMU-28 SPRAY TANK		F-1935 E-567	4.9	27.6	N A
CTU-2/A SUPPLY CONTAINER		213	4.9	11.8	N A

N A – NOT APPLICABLE
N E–NOT ESTABLISHED
F – FULL
E–EMPTY
* TOTAL CARGO WEIGHT SHALL AT NO TIME EXCEED 300 POUNDS.
** THIS INCLUDES 57 POUNDS FOR ECM ADAPTER.

4E-1-(298-4)51

Figure A1-1 (Sheet 4 of 4)

GLOSSARY

A

AC – Aerodynamic center

ACM – Air Combat Maneuvering

ac – Alternating current

ACU – Avionics Computer Unit

ADCS – Air Data Computer Set

ADI – Attitude Director Indicator

AFC – Automatic Frequency Control

AFCS – Automatic Flight Control System

AGC – Automatic Gain Control

AHRS – Attitude Heading Reference System

AIU – Avionics Interface Unit

AJB – Airborne, Electro–Mechanical, Bombing

AOA – Angle of Attack

APA – Airborne, Radar, Auxiliary Assembly

APN – Airborne, Radar, Navigational Aid

APQ – Airborne, Radar, Special Purpose

APU – Auxiliary Power Unit

AR – Air Refueling

ARI– Aileron Rudder Interconnect

ARC – Airborne, Radio, Control

ASA – Airborne, Special Type, Auxiliary Assembly

ASE – Allowable Steering Error

ASN – Airborne, Special Type, Navigational Aid

ASQ – Airborne, Special Type, Combination of Purposes

AVTR – Airborne Video Tape Recorder

AWW – Airborne, Armament, Control

B

BATH – Best Available True Heading (Alignment)

BDHI – Bearing Distance Heading Indicator

BIT – Built–In–Test

BST – Boresight

C

CAA – Computer Automatic Acquisition

CADC – Central Air Data Computer

CAP – Combat Air Patrol

CARA – Combined Altitude Radar Altimeter

CAS – Calibrated Airspeed

CDU – Control Display Unit

CG – Center of Gravity

CIT – Compressor Inlet Temperature

CMPTR – Computer

CNI – Communication Navigation Identification

CSD – Constant Speed Drive

D

dc – Direct current

DCU – Douglas Control Unit

DMAS – Digital Modular Avionics System

DME – Distance Measuring Equipment

DR – Dead Reckoning

DSCG – Digital Scan Converter Group (Radar type)

DTC – Data Transfer Cartridge

DTU – Data Transfer Unit

DTS – Data Transfer Set

DVST – Direct View Storage Tube (Radar type)

E

EAS – Equivalent Airspeed

ECM – Electronic Countermeasure(s)

EGT – Exhaust Gas Temperature

F

FD – Flight Director

FL – Flight Level

FSK – Function Select Key (CDU)

GLOSSARY (CONT)

G

G – Gravity

GC – Gyro Compass (Alignment)

GCA – Ground Control Approach

GCI – Ground Control Intercept

gpm – Gallon per minute

H

Hangfire – A delay or failure of an article of ordnance after being triggered

Hang Start – A start that results in a stagnated rpm and temperature

Hot Start – A start that exceeds normal starting temperatures

HSI – Horizontal Situation Indicator

Hz – Hertz

I

IAS – Indicated Airspeed

IFF – Identification Friend or Foe

IFR – Instrument Flight Rules

ILS – Instrument Landing System

IMC – Instrument Meteorological Conditions

INS – Inertial Navigation System

INU – Inertial Navigation Unit

IP – Identification Point

I/P – Identification of Position

IR – Infrared

J

JP – Jet Propulsion

K

KTS – Knots

L

LABS – Low Altitude Bombing System

LCOSS – Lead Computing Optical Sight

LE – Leading Edge

LOX – Liquid Oxygen

Lpm – Liters per minute

LRU – Line Replaceable Unit

M

MAC – Mean Aerodynamic Chord

MIL – Military

Misfire – A permanent failure of an article of ordnance being triggered

MSDG – Multiple Sensor Display Group

MSL – Mean Sea Level

N

N/A – Not applicable

NAV – Navigate

N/E – Not established

NFSP – Navigation Function Select Panel

NMPP – Nautical Miles Per Pound

NWDS – Navigation Weapon Delivery System

O

OAT – Outside Air Temperature

OFP – Operational Flight Program

OV – Overfly Update

P

P – Pilot

PC – Power Control

PDVL – Pull Down Vent Line

PLB – Personnel locator beacon

prf – Pulse repetition frequency

psi – Pounds per square inch

Q

q – Dynamic Pressure, psf

GLOSSARY (CONT)

R

RADAR – Radio Detection and Ranging

RER – Radial Error Rate

rf – Radio Frequency

rpm – Revolutions Per Minute

RWR – Radar Warning Receiver

S

SC – Sensor Control Display (CDU Display)

SCADC – Standard Central Air Data Computer

SH – Stored Heading (Alignment)

SID – Standard Instrument Departure

SPC – Static Pressure Compensator

SRP – Sensor Reference Point

T

TACAN – Tactical Air Navigation

TAS – True Airspeed

TE – Trailing Edge

TISEO – Target Identification System Electro–Optical

TMN – True Mach Number

U

UHF – Ultra High Frequency

V

VFR – Visual Flight Rules

VHF – Very High Frequency

VMC – Visual Meteorological Conditions

Vn – Velocity Acceleration Relationship

VORTAC – Very High Frequency – Omni Range and Tactical Air Navigation

W

WSO – Weapons System Officer

ALPHABETICAL INDEX

NOTE

All text and illustrations numbers in this alphabetical index refer to page numbers, illustration page numbers are shown in parenthesis.

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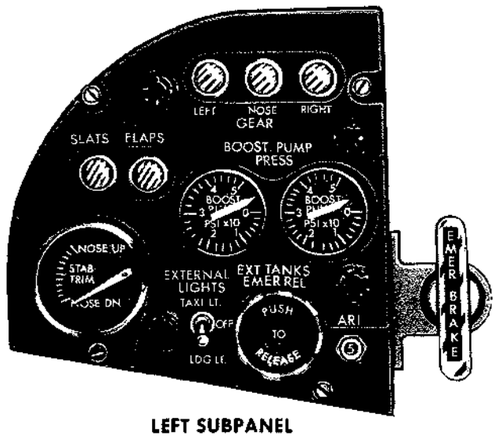
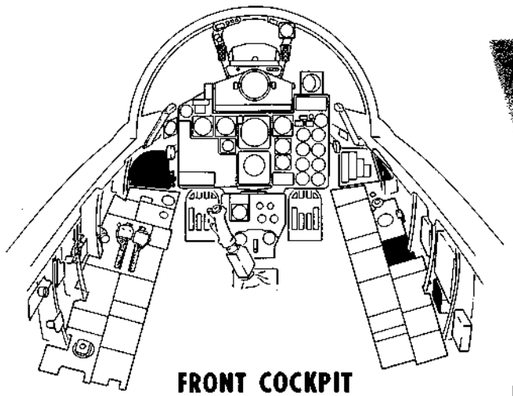
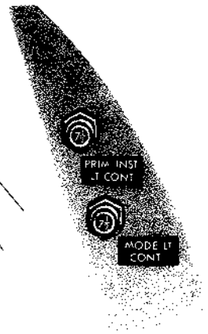


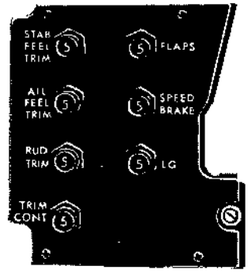
LEFT SUBPANEL



FRONT COCKPIT

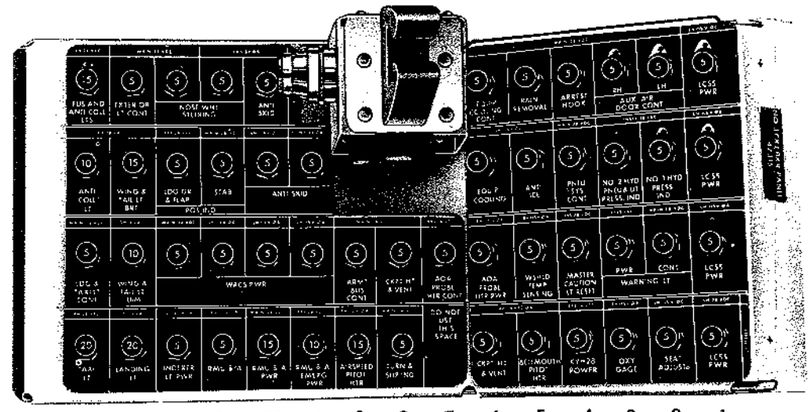


INSTRUMENT LIGHTS INTENSITY CIRCUIT BREAKER PANEL



CIRCUIT BREAKER PANEL

STANDBY ATTITUDE CIRCUIT BREAKER AND INTENSITY CONTROL PANEL



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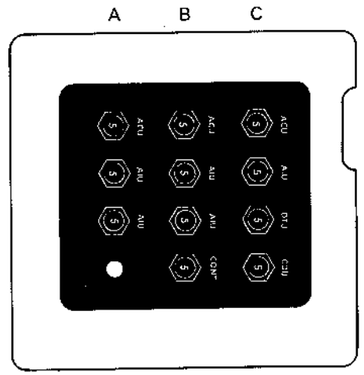
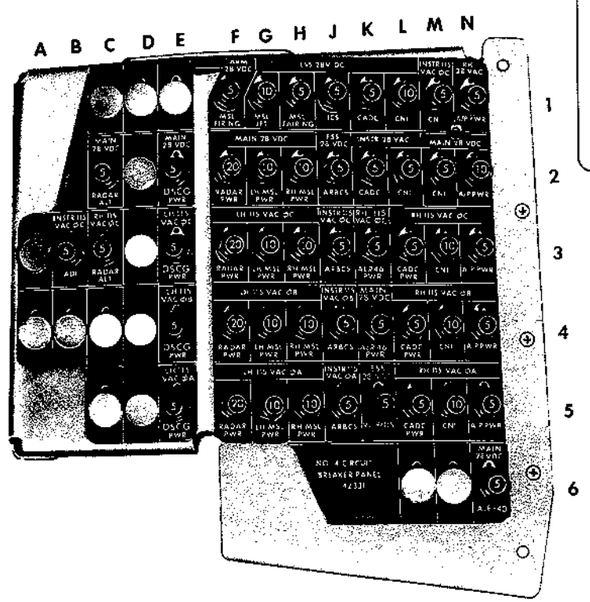
A B C D

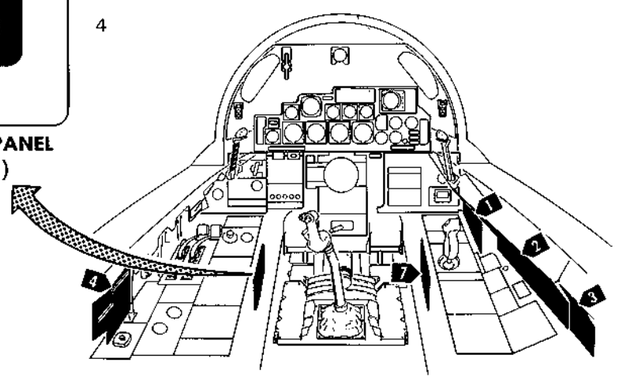
CIRCUIT BREAKER PANEL NO. 3



NWDS CIRCUIT BREAKER PANEL (AFTER TO 1F-4E-671)



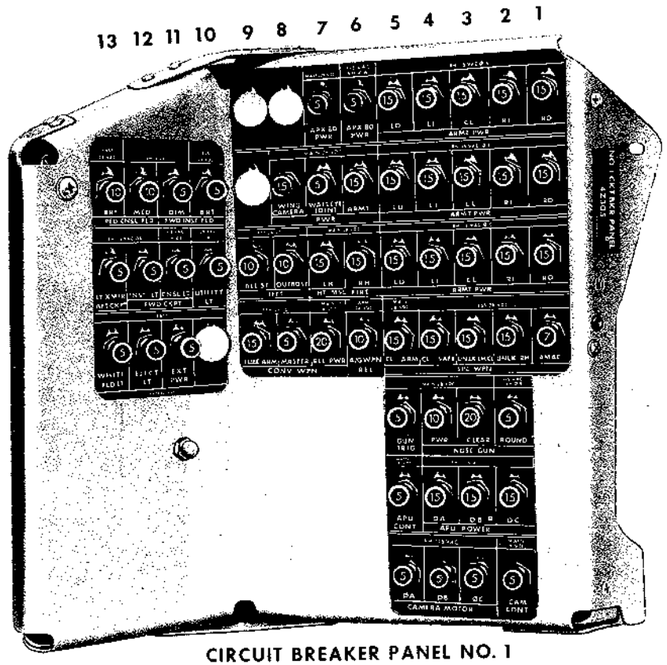
CIRCUIT BREAKER PANEL NO. 4



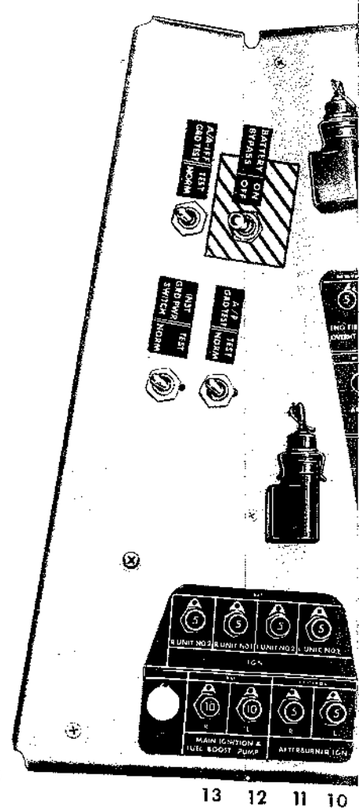
REAR COCKPIT

Note

CIRCUIT BREAKER PANELS SHOWN ARE TO ILLUSTRATE THE ZONE REFERENCE SYSTEM AND ARE NOT INTENDED TO DEFINE THE CIRCUIT BREAKER PANEL CONFIGURATION IN A PARTICULAR AIRCRAFT.



CIRCUIT BREAKER PANEL NO. 1



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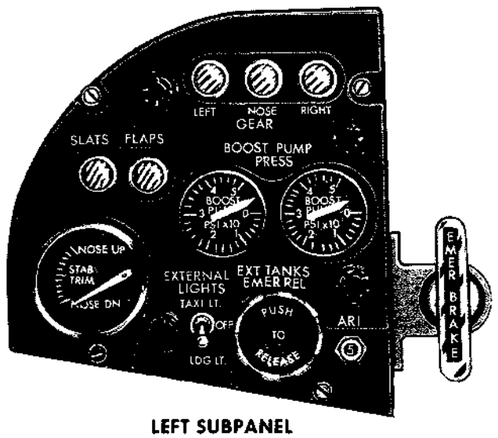
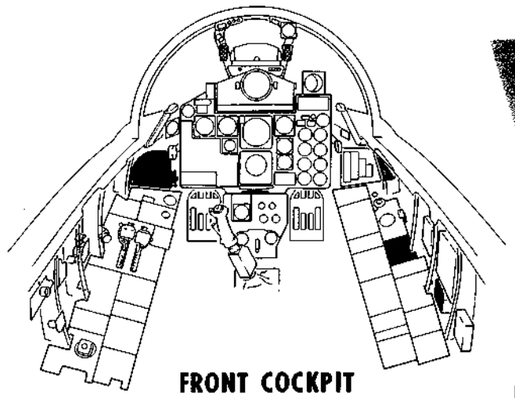


LEFT SUBPANEL



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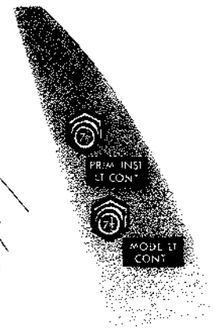
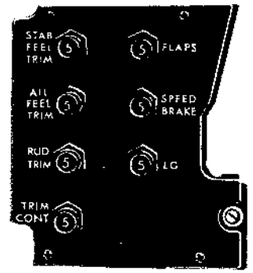
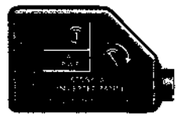


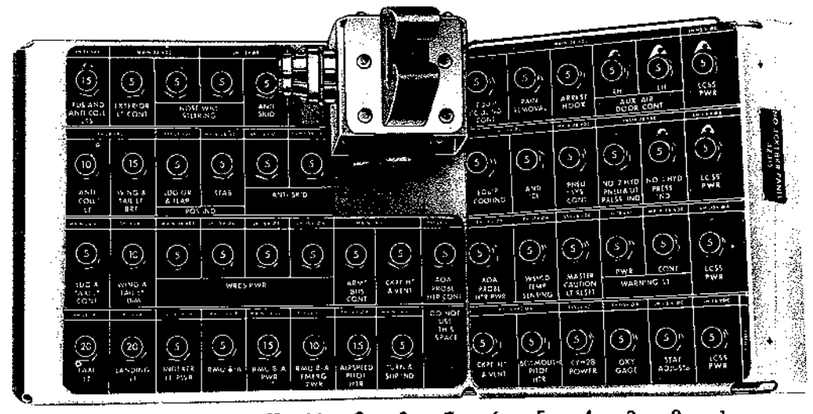
INSTRUMENT LIGHTS INTENSITY CIRCUIT BREAKER PANEL



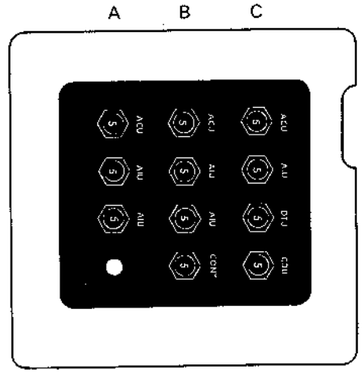
CIRCUIT BREAKER PANEL



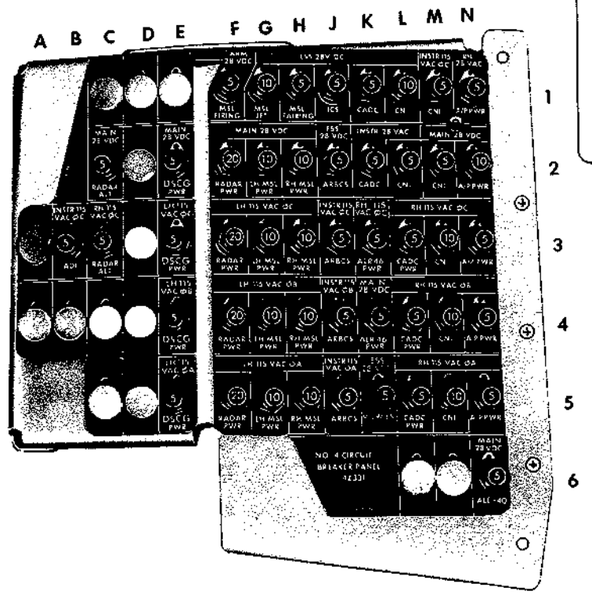
STANDBY ATTITUDE CIRCUIT BREAKER AND INTENSITY CONTROL PANEL



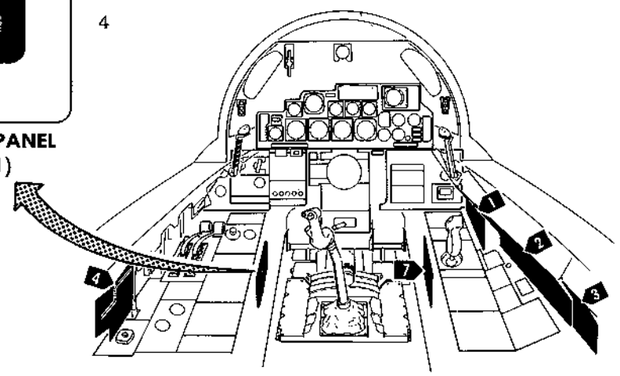
CIRCUIT BREAKER PANEL NO. 3



NWDS CIRCUIT BREAKER PANEL (AFTER TO 1F-4E-671)



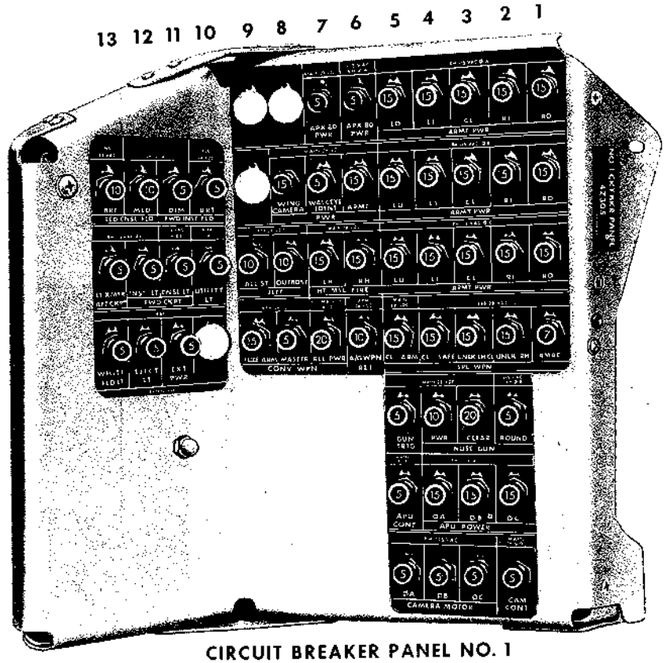
CIRCUIT BREAKER PANEL NO. 4



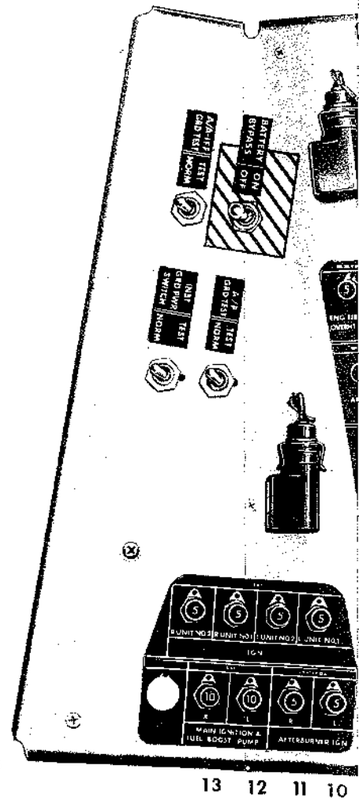
REAR COCKPIT

Note

CIRCUIT BREAKER PANELS SHOWN ARE TO ILLUSTRATE THE ZONE REFERENCE SYSTEM AND ARE NOT INTENDED TO DEFINE THE CIRCUIT BREAKER PANEL CONFIGURATION IN A PARTICULAR AIRCRAFT.



CIRCUIT BREAKER PANEL NO. 1



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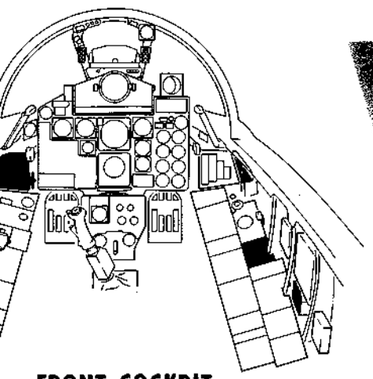
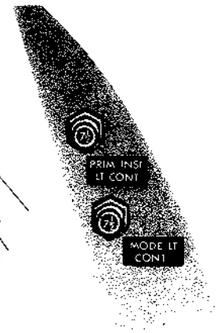
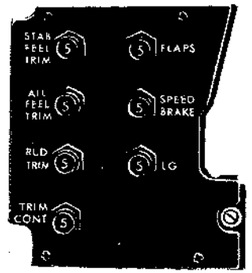


FRONT COCKPIT

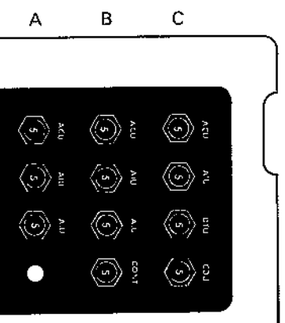


INSTRUMENT LIGHTS INTENSITY CIRCUIT BREAKER PANEL

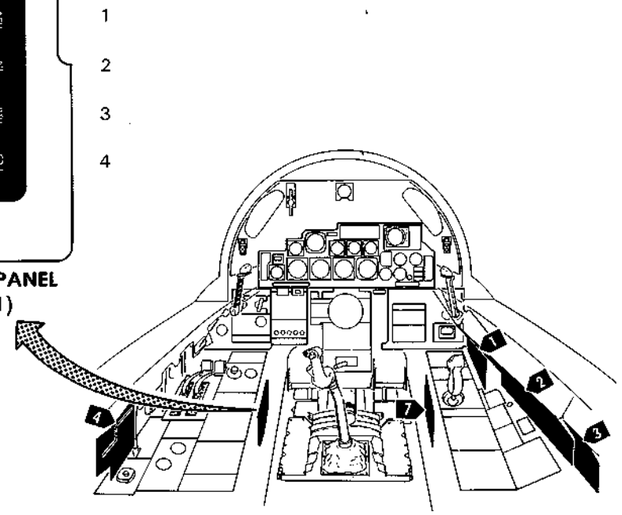


CIRCUIT BREAKER PANEL

STANDBY ATTITUDE CIRCUIT BREAKER AND INTENSITY CONTROL PANEL



OS CIRCUIT BREAKER PANEL (AFTER TO 1F-4E-671)



REAR COCKPIT

Note

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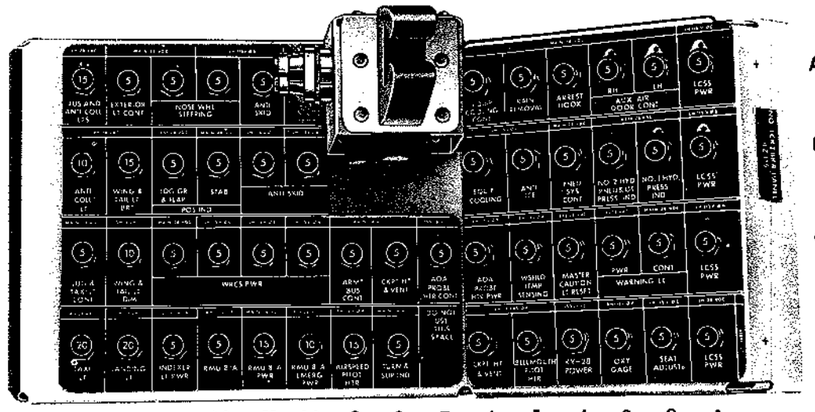
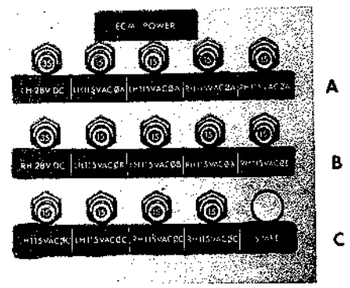
CIRCUIT BREAKERS

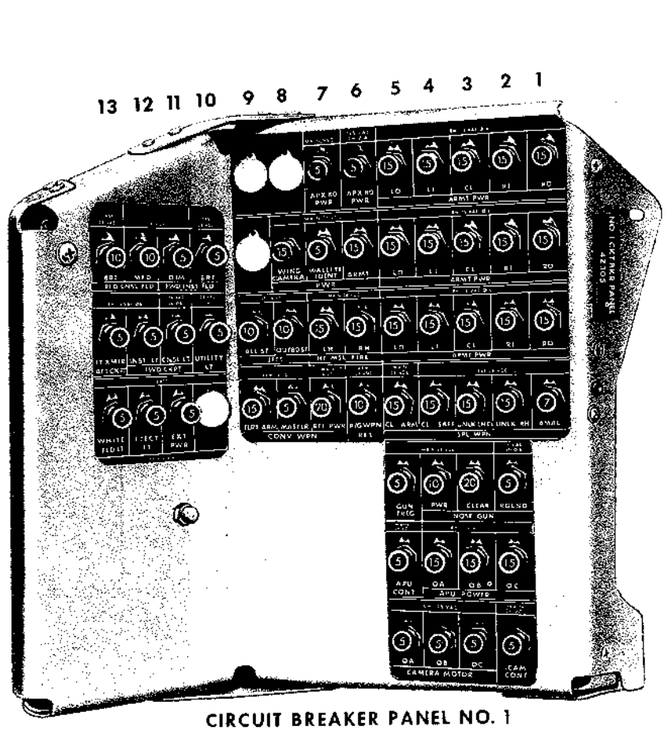
TYPICAL



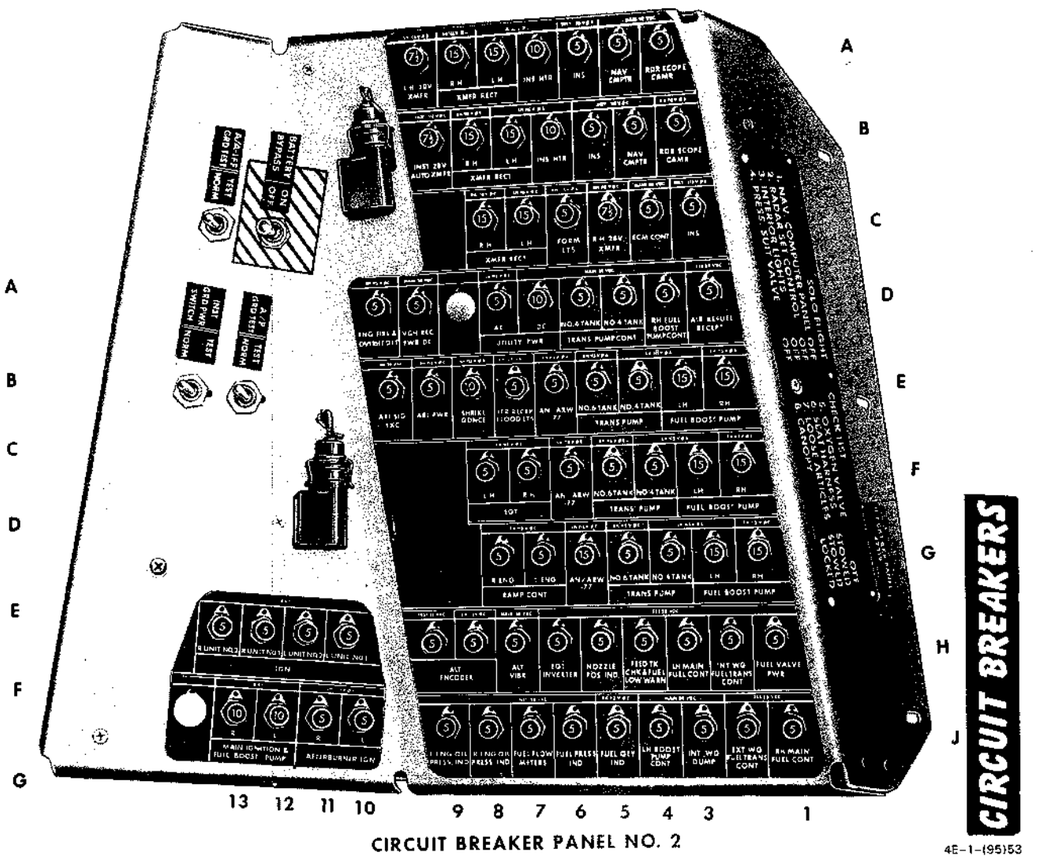
CIRCUIT BREAKER PANEL NO. 3



CIRCUIT BREAKER PANEL NO. 7



CIRCUIT BREAKER PANEL NO. 1



CIRCUIT BREAKER PANEL NO. 2

4E-1-(95)53

Figure FO-15